SCIENTIFIC AMERICAN

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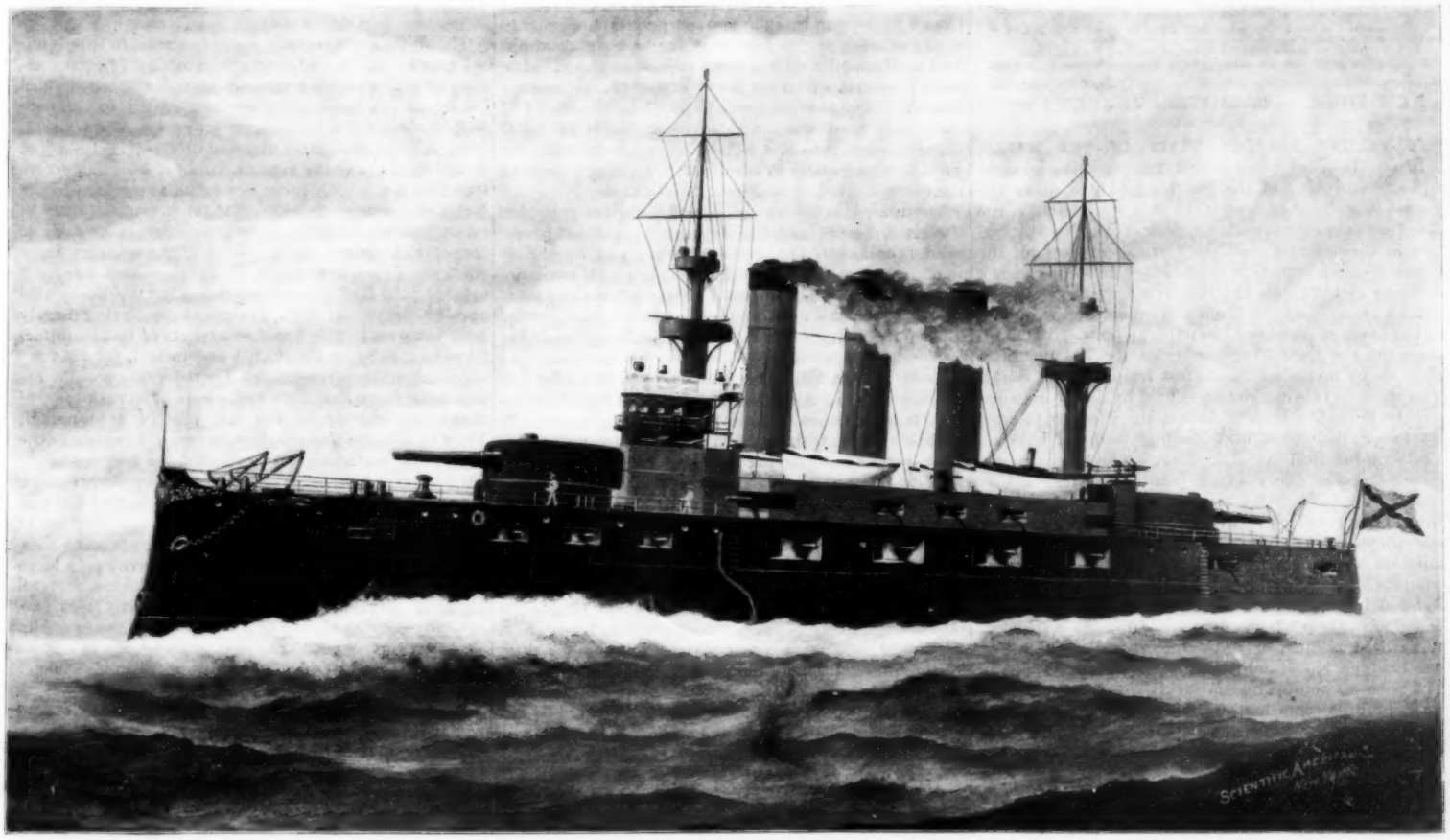
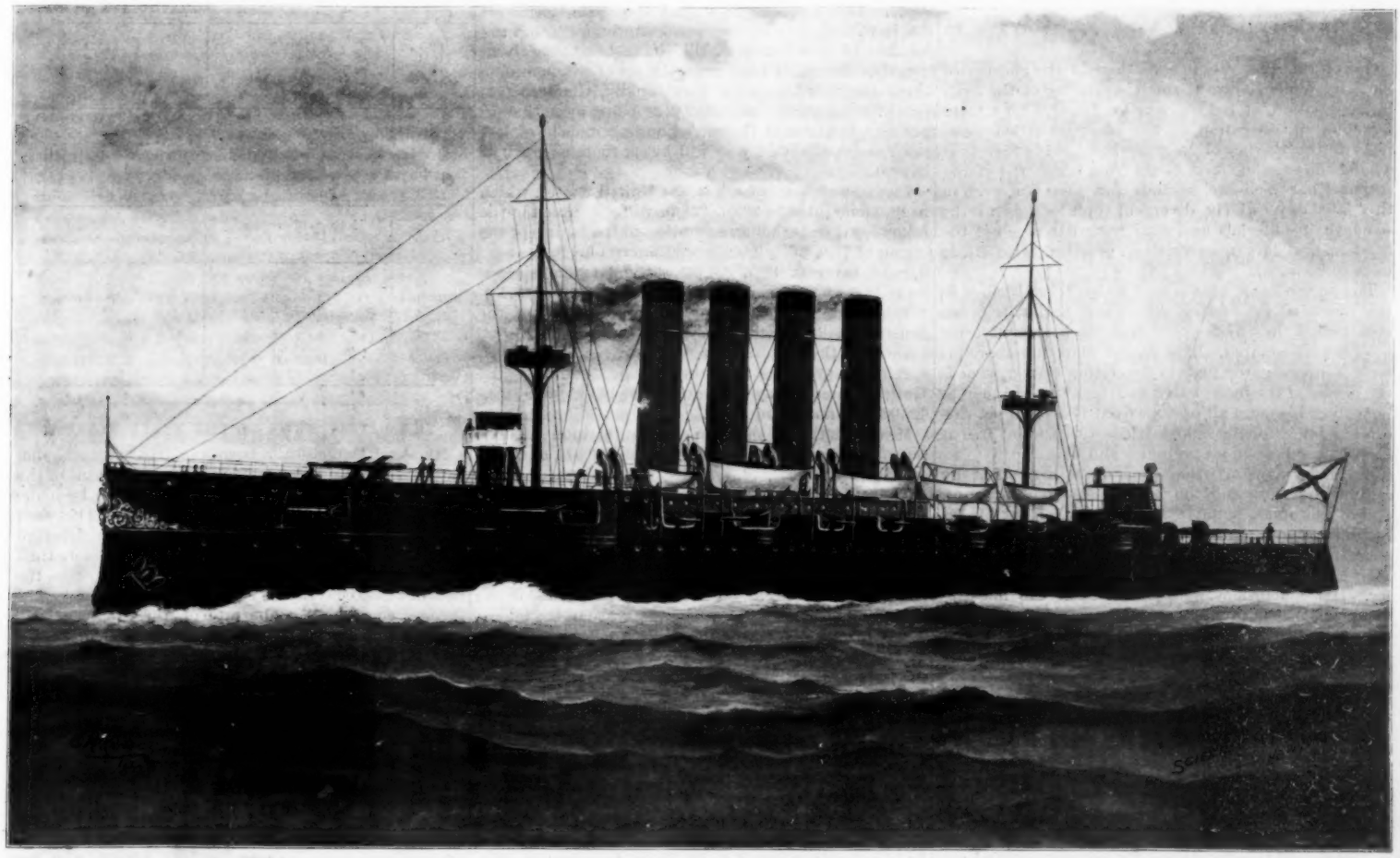


NEW RUSSIAN BATTLESHIP.

DISPLACEMENT, 12,700 tons. SPEED, 18 knots on twelve hours trial. ARMOR: Belt, 9 inches; upper belt, 6 inches; deck, 2 inches on flat, 4 inches on slopes. ARMAMENT, four 12-inch guns, twelve 6-inch rapid-fire, twenty 3-inch rapid-fire, two 2¼-inch rapid-fire, twenty 1⅜-inch rapid-fire, and six 1¼-inch rapid-fire guns. TORPEDO TUBES, six.



NEW RUSSIAN CRUISER.

DISPLACEMENT, 6,500 tons. SPEED, 23 knots on twelve hours trial. ARMOR: Deck 1½ inches on flat; 3 inches on slopes. ARMAMENT, twelve 6-inch rapid-fire, twelve 3-inch rapid-fire, six 1⅜-inch rapid-fire guns. TORPEDO TUBES, four.

AMERICAN-BUILT SHIPS FOR THE RUSSIAN NAVY.—[See page 294.]

Scientific American.

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NEW YORK, SATURDAY, NOVEMBER 5, 1898.

THE FASTEST REGULAR TRAIN IN THE WORLD.

In our issue of September 3, 1898, we gave an illustrated description of the two trains which make the fastest long-distance runs without a stop, namely, the Empire State express, of the New York Central system in this country, and the Cornish express, of the Great Western system in England. The former runs a distance of 142·8 miles at the average speed of 53·58 miles an hour, and the English train covers 193·9 miles at the average speed of 53·36 miles an hour. Although these are the fastest regular trains for the distance, they are by no means the fastest trains in the world. The claim to this distinction is held by a truly remarkable train that runs daily during the summer months on the Philadelphia and Reading Railroad between Philadelphia and Atlantic City. The distance between Camden, the starting point, and Atlantic City is 55·5 miles. The road is a practically level one and the curvature is light. The trains are timed to make the run without a stop in 50 minutes at the rate of 66·6 miles an hour, a feat which is regularly and easily accomplished, for it is not unusual for the distance to be covered in considerably less time than this. On one occasion the trip was made in 47½ minutes—a speed of 70·1 miles an hour; while the record run of the season was made in 44·75 minutes, or at an average speed of 74·4 miles an hour. These are truly wonderful performances, and as mere feats of fast running, irrespective of the distance covered, they place the Atlantic City flier in an unquestionable position as the fastest regular train in the world.

Additional merit attaches to the run from the fact that the train is by no means a light one. On the day when the record was made it consisted of a combination car weighing 57,200 pounds, a Pullman car weighing 85,500 pounds, and four day coaches weighing 236,800 pounds, a total train load of 379,500 pounds.

EXPERIMENT THE TRUE BASIS OF ENGINEERING DATA.

One of the most valuable features in the address of Sir John Wolfe Barry, at the late meeting of the British Association, at Bristol, was his demand for a more searching investigation of the many unsettled questions in the Science of Engineering. It is a fact that among the excellent text books from which the young engineer has to choose, he finds that there are, even in this late day, widely divergent opinions as to the strength of materials and with regard to much of the fundamental data upon which all practical calculations have to be based.

The only reliable data is that which is established as the result of exhaustive experiment and widespread observation, in which every possible source of error has been eliminated. The proper plan of research is for the investigator first to determine clearly what is the nature of the information he is seeking, and then to put out of his mind all preconceived ideas and pet theories, seeking for the naked truth with a mind free as far as possible from all prejudice and bias.

As an instance of wrong conclusions arrived at by arguing on false and too hastily accepted premises, one of the most familiar and famous is that of Dr. Lardner, who stated in 1836 that the whole idea of ocean steam navigation on voyages as long as from Bristol to New York was, at that epoch, an abstract impossibility. His conclusions were based upon the false assumption that in proportion as the capacity of a vessel is increased, in the same ratio, or nearly so, must the mechanical power of the engines and the consumption of coal be augmented.

Another instance of hasty generalization is the excessive allowances for wind pressure which have frequently been adopted in designing important structures. The most notable case of this is the great Forth Bridge in Scotland, in which provision was made—in accordance with a regulation of the Board of Trade issued in 1880, immediately after the fall of the Tay Bridge—for a wind pressure of 56 pounds on every square foot of the structure. Experiments carried out during the building of the bridge to determine the actual amount of wind pressure at the site, experiments which extended (as they should do to have a real value) over several years, brought to light the fact that the maximum pressures recorded on small surfaces were never found to extend uniformly over larger surfaces. Thus a large wind gage of 300 square feet area registered pressures 38·7 per cent less than those registered on a much smaller gage under the same conditions. Experiments during the building of the Tower Bridge, London, established the same results in a yet more marked degree, for, using the bascules of the bridge, whose area is 5,000 square feet, as a great wind gage, it was found that while they registered an average pressure of 1 to 1·5 pounds per square foot for the whole surface, a small gage in the neighborhood, subject to the same conditions, showed a pressure of from 6 to 9 pounds. These experiments brought to light the unsuspected fact that for some reason, not well understood, a gale of wind presents areas of maximum pressures which are far in excess of the average pressure. The 56-pound unit imposed by the Board of Trade has unquestionably led to a weight of metal being worked into the Forth Bridge, to provide for wind strains, greatly in excess of the requirements of the case.

The above is only one of many instances in which the need of exact and scientifically ascertained physical data is keenly felt in engineering and other constructive work. A notable instance of this is our ignorance of the average strength of the different kinds of timber which are used in bridge or roof work, or for other purposes where it is desirable for purposes of economy or appearance to know the minimum amount of material that will serve the purpose. The Fernow investigations of American woods are a valuable contribution to science as far as they go, and it is sincerely to be hoped that the needed government appropriations will be forthcoming to enable them to be carried to completion.

An effort is being made in England to have created a Public Physical Laboratory, in which engineering data can be scientifically determined, and a government committee has reported favorably of its establishment. The value of such an institution cannot be called in question, and the establishment of such a laboratory in any country would provide a center to which the mass of results arrived at by detached investigators might be submitted, and where by its own careful and systematized work a standard of units might be prepared which would be accepted as final by our own mechanics, architects, and engineers.

AMERICAN SILK MANUFACTURES AND EXPORTS.

The announcement that the silk manufacturers of the United States are rapidly increasing the exportation of their products adds interest to some recently compiled statements by the Treasury Bureau of Statistics regarding the silk manufactures and importations and exportations of this country during the past few years. These figures show that the manufacture of silk in this country has increased enormously, that the imports of manufactured silk have meantime been greatly reduced, and the exportations of silk manufactures are now increasing very rapidly, the total exports for the present calendar year being more than 50 per cent in excess of the corresponding months of last year, and for the full year will be six times as much as in 1890.

The manufacture of silk in the United States, which in 1860 amounted to $6,607,771 in value, doubled in the following decade, being, according to the figures of the census of 1870, $12,210,662, more than trebled in the next decade, being in 1880, $41,033,045, and again doubled from 1880 to 1890, being in the latter year, $87,298,454. While a recent compilation by the secretary of the American Silk Association shows that in the five years since 1890 the rate of increase has even accelerated, making it probable that the silk production of the United States to-day amounts to nearly or quite $150,000,000 per annum in value.

Meantime the importation of manufactured silks has fallen rapidly, that of 1890 being $38,686,374, and that of 1898 only $23,523,110.

That the manufacture of silk goods in the United States has increased very rapidly within the past year is apparent. Importations of raw silk, which in the fiscal year 1897 were 6,513,612 pounds, were, in 1898, 10,315,161 pounds; and the total value of raw silk imported in 1898 was $31,446,800, against $18,918,283 in the preceding year. This enormous increase in the importation of raw silk is doubtless accounted for, not only by the activity in the great silk manufacturing centers of this country, but also by the recent announcement that numerous cotton factories in the New England and the Middle States have substituted silk manufacturing machinery for that formerly used in the manufacture of cotton goods now largely supplied by the mills located nearer to the cotton fields of the South.

The growth in the importations of unmanufactured silk, which of course measure the manufacture of silk, has been steady and rapid during the past thirty years. In 1868 they amounted to $2,520,404 in value; in 1878, $5,995,567; in 1888, $19,931,682; and in 1898, $31,446,800. In the single item of "silk raw, or as reeled from the cocoons" the importations of 1868 were 512,449 pounds; in 1878, 1,182,750 pounds; in 1888, 5,173,840 pounds; and in 1898, 10,315,161 pounds. During the earlier part of this period importers held their own in the contest for the field, but in the last decade have fallen practically out of the race. In 1868 the importations of manufactured silk were $17,777,627; in 1878, $19,837,972; in 1888, $33,350,999; in 1890, $38,686,374; and in 1898, $23,523,110.

Meantime our manufacturers have apparently begun giving their attention to the foreign market; their exports, which in 1878 were $19,032, having increased to $56,659 in 1888, $161,673 in 1893, and $297,074 in 1898. During the month of August, 1898, the exports were $27,251, against $21,400 in August, 1897, an increase of 30 per cent in a single year.

The success of American manufacturers in supplying the home demand and obtaining a foothold in the markets of the world is the more strongly marked since other nations have failed in their efforts to compete with the great silk manufacturing nation of the world, France. The statistical abstract of Great Britain just issued shows that the exportation of silk manufactures from the United Kingdom has fallen 50 per cent in the last decade, being in 1897, 1,338,161 pounds sterling in value, against 2,664,244 pounds st rling in 1888, while the official reports of the German government show that the silk exportations of that country have decreased in a like proportion, being $45,000,000 in 1889 and $26,000,000 in 1897, France alone having barely held her own in this line, her exports of silk manufactures in 1890 being $52,862,700, and in 1897, $52,283,700.

Silk manufacturing in the United States, while begun nearly a half century ago, seems to have developed almost exclusively in the last half of that period. Prior to 1870 the importations of raw silk for use in the manufactories in this country had never reached 1,000,000 pounds, while, as already stated, they were, in 1898, more than 10,000,000 pounds. During the civil war and in the years immediately following the manufacture of plain dress silks was begun, while at the present time brocaded silks and satins are manufactured on a large scale, and the manufacture of silk plushes and all varieties of upholstered goods has recently been successfully developed. In 1860 our manufacturers of silk supplied but about 15 per cent of the consumption in the United States; by 1870 they were supplying 30 per cent of the amount consumed in the United States; by 1880, more than 50 per cent; in 1890, 70 per cent; and to-day it is estimated that 85 per cent of the silk goods used in the United States are the products of our own factories.

The following table presents the number of silk manufacturing establishments in the United States and value of their products, shown by each census since 1860:

Year.	Number of establishments.	Value of products.
1860	139	$6,607,771
1870	86	12,210,662
1880	382	41,033,045
1890	472	87,298,454

The following table shows the imports of raw silk and value of manufactured silks during the past thirty years by five-year periods:

Year.	Imports of raw silk. (Pounds.)	Imports of silk manufactures.
1868	512,449	$17,777,627
1873	1,150,420	29,990,035
1878	1,182,750	19,837,972
1883	3,253,370	36,764,726
1888	5,173,840	33,350 999
1893	7,422,430	38,958,928
1898	10.315,161	23,523,110

THE LATEST NEWS OF THE NOBEL BEQUEST.

Mr. Axel Danielson, a correspondent of Stockholm, Sweden, is keeping us informed as to the status of the Nobel bequest. He says that the case has been decided, or rather a compromise has been effected between the contesting parties. The relatives of the deceased will receive 3,800,000 Swedish crowns, a little more than $1,000,000, so that there still remains for the prizes the sum of 25,000,000 crowns, equivalent to $6,950,000. The income, computed at the rate of three per cent, will make the five prizes worth 150,000 crowns or $41,600 each. It is expected that the compound interest during the time, which will necessarily be long, that will elapse before the prizes can be awarded will increase the capital so as to cover the cost of managing the funds and the work entailed in properly distributing the prizes. It will be remembered that these prizes are to be awarded annually to persons making the most important discoveries in physics, chemistry, physiology or medicine. There is also to be a prize for the best literary contribution upon the subject of physiology or medicine, and also one for any person who has achieved the most or done the best things looking toward the promotion of the cause of peace throughout the world.

VALUABLE BY-PRODUCTS OF COTTON.

The question of opening up the markets of Japan and the far East for our cotton has given the Southern growers a slight hope for better times; but, while the prospects of another large crop keep prices down, and affect the planters disastrously, science is steadily laboring to widen the field of consumption and to create new industries that will utilize all of the by-products of the crop. The achievements in this direction have been so noteworthy in the past that one is led to place implicit confidence in the promises for the future. By the single discovery of the value of the cotton seed for manufacturing oil and cotton-seed meal, some ten to fifteen million dollars were added to the receipts of the annual cotton crop. Now that an enormous industry has been built up and permanently established for converting the cotton seed into oil, the question of utilizing other parts of the cotton plant for commercial purposes has come rapidly to the front.

Originally the lint was considered the only valuable part of the cotton crop, and the seeds, the stalks, the roots, and hulls were either burned on the land or turned under the soil by the plow to increase the fertility of the land. It was supposed that the cotton drew so much fertility from the soil that it would soon rob it of all power for plant production and in time make it worthless. Scientific investigations and analysis of the soil have demonstrated, however, that, of all the staple crops, cotton imposes the slightest drain upon the land. By applying special fertilizers, all of the crop can be removed year after year without materially injuring the soil. Thus cotton has been raised on the same plantations for over half a century, and the land to-day is almost as fertile as when the virgin soil was first broken with the old wooden plow.

This demonstration has led to important results. After the cotton seed, the cotton-seed hulls were selected for scientific investigation. The hulls of a cotton crop constitute about half the weight of the ginned seed. These hulls are hard, dry, and apparently useless, and they are covered with a fuzzy lint that further detracts from their appearance. In fact, until very recently they had no practical value, and they were disposed of in various ways by different planters. The majority returned them to the soil to help fertilize it; but analysis showed that their constituent elements did not enrich the land to any great extent.

But as substitutes for hay the cotton-seed hulls are of incalculable value. Heretofore the hulls have been used by a good many of the cotton-seed mills for fuel, and as fuel they are worth about 80 cents to 90 cents per ton; but as animal food they are worth far more. Experiments were first made a few years ago in the vicinities of the oil manufacturing centers, such as Memphis, New Orleans, Houston, Little Rock, Raleigh, and Atlanta. It was found that when mixed with condensed foods the hulls were readily eaten by the animals, and that they were of great value in helping to digest and assimilate bran, cracked corn, and meal. Moreover, it was proved by a succession of feeding tests that 10 per cent of the protein of the hulls was digestible, 38 per cent of the fiber, 40 per cent of the nitrogen extract, and 77 per cent of the fat. The hulls are light and bulky, but otherwise they make a good substitute for hay in the South, where grass crops have always been notoriously small and inferior. The hulls are baled or pressed into sacks, and in this condition they keep for a long time. When packed away in bulk, like hay, they ferment and heat.

Now that the cotton seeds and hulls have been profitably disposed of, the stems of the plants have attracted attention, and already they have been successfully utilized. As a by-product of the cotton crop, the stems promise to prove as important as the hulls. The plants of the cotton crop have long ranked in the South as a coarse animal food, about equal to the same quantity of rye, wheat, or oat straw. After the crop was harvested the animals were generally turned loose on the land, and they would eat the stubble in places and grind some of it into the soil. These stems would be stripped of their foliage and tender twigs by the cattle, but the hardy, dry stalks would be left untouched.

The question of utilizing these stems as fiber for cotton bagging attracted attention some years ago, but it was only recently that a process was patented for this purpose. The stems are very rough and coarse, and scientists found some difficulty in making machinery that would work up the material satisfactorily. The fiber was found to be good when once stripped and sorted out. Samples of the bagging made from the stems have been tested in the South, and it is pronounced by experts to be first-class in every way. The yield of the fiber is large, and when satisfactory machinery is produced a considerable bagging industry will be built up near the cotton fields. Five tons of good stalk will yield about 1,500 pounds of first-class fiber. At this rate the annual cotton crop will produce all the bagging needed for cotton baling and leave a good percentage for other purposes. Of course the industry is largely in the experimental stages yet, but if it works as well as the cotton-seed oil industry did, it will not be many years before it will assume gigantic proportions.

In Egypt, the common cotton of the Nile districts (Gossylii radicis cortex) produces a large root, the bark of which has long been used for medicinal purposes. The action of this bark is similar to that of ergot. This fact has led to investigations here, and it is believed that another by-product of the cotton crop will be soon found in the roots of the plants. The drug would be useful in many ways and might prove of great value. Chemists have approved of it, and it is now largely a question of extracting it profitably.

In connection with employing the cotton-seed hulls as food for animals, it might be said that any surplus of the crop can be utilized in making artificial fertilizers. Cotton-hull ashes are very valuable for furnishing a cheap potash for the tobacco crop, and there is quite a demand for it in all of the tobacco growing districts of this country. The quality of these ashes varies, but, as a rule, they are of considerable value.

This leaves little of the cotton plant either to go to waste or to be returned to the soil. Every part of it is turned to some profitable use, and as the years go by new uses for the products will be discovered. Already the cotton-seed oil—the most valuable by-product of the crop—has found its way into fields never dreamed of when it was first extracted. Improved methods of refining it are gradually forcing the oil into direct competition with more expensive oils. It has been found that the upland cotton seeds yield a purer and better oil than the cotton raised along the seacoast. The climate also has much to do with the quality of the oil, and under the same conditions, cotton-seed oil made in this country is superior to that manufactured of the Egyptian or Indian cotton seed. The oil first extracted by expression is odorless, and of a dark, brownish-green color. This is treated with alkaline solutions, and a clear, yellow, pleasant, and odorless oil is produced. The residue is called soap stock and enters largely into the manufacture of soaps. The refined oil is consumed chiefly as a food product, as it makes a good substitute for salad and cooking oils, and also for packing sardines and other fish. It has its limits, however, and the manufacturers have not been able to make it take the place of oils for mixing paints and wood-fillers. It dries very slowly and imperfectly, and this seems to debar it forever from entering into competition with linseed and similar oils for the drug and paint trade. As a lubricant, the best refined cotton-seed oil is very satisfactory, and it is in considerable demand in the machine trade.

Refining processes are constantly developing new uses for the oil. The yellow oil resulting from the first process of refining, through treatment with alkaline solutions, is further purified by heating and filtration. Then the white oil of commerce is obtained by shaking the yellow oil with 2 to 3 per cent of fuller's earth. In purifying the yellow oil about 25 per cent of it is separated in the form of stearin. This cotton-seed stearin is employed in making candles and the various preparations of butter and lard surrogates.

For some time this cotton-seed oil was mixed with lard intended for cold climates, and then its fluidity was corrected by mixing it with beef fat. Now this is often sold on its own merits in the market in open competition with lard.

Finally, there is a wash powder made from the soap stock that owes its origin to cotton-seed oil. This is obtained from the residue left after the oil is refined. The soap itself, made from the oil, is used extensively by the woolen mills of this and other countries. It has been found to be of special value in washing woolen goods, which it does not injure nor cause to shrink.

Thus it is that the by-products of the cotton crop are multiplying, and in the end they may prove more valuable than the lint. At present not much more than one-third of the cotton seed is used for manufacturing oil and similar products; but, as the demand increases, and facilities improve for handling the seed, the value of the crop will increase, and in time cotton-seed oil will represent an annual value more than equal to the actual worth of the cotton lint.

THE PLAGUE IN VIENNA.

The outbreak of the bubonic plague in Vienna, due to the experiments in Prof. Nothnagle's bacteriological establishment, has spread terror in the Austrian capital. They have several cases in addition to those which resulted in the death of Dr. Mueller and Herr Barisch. Dr. Mueller was considered an authority on the plague and spent some time in Bombay for the purpose of studying the plague on the spot, and he survived all the dangers of this place to succumb to the deadly bacillus at Vienna. Extraordinary precautions have now been taken to prevent an epidemic. The plague patients lie in an isolated building and are attended by Dr. Pooch, a volunteer physician, and by Sisters of Charity. They are cut off by a rope which no one is allowed to pass. The doctor writes the prescriptions and pastes them on the window pane. The doctors outside read them and have the medicines put up and they are placed on the window ledge; after they have retired to a safe distance, the medicines are taken inside. Food is conveyed to the patients and their attendants by the Sisters of Charity in a similar manner and a telephone is used to give information regarding the changes in the patients' condition. Everyone who came in contact with Herr Barisch has been isolated. Some of them attempted to escape, but they were all captured and locked up, but it is feared the precautions were taken too late. Both he and his wife have visited friends, rode in public conveyances, and came in contact with dozens of persons, which has resulted in great excitement in medical circles. It is the opinion of the doctors at the Austrian capital that the plague is likely to spread. A temporary hospital was erected by torchlight. Dr. Mueller heroically took observations of his own condition and the questions of the disease until he died. His coffin was partially filled with sawdust saturated with carbolic acid. All bacteriological observations have been suspended, and the animals used in the experiments have been burned.

PATENTS AND COPYRIGHTS IN CHINA.

Under date of July 18, United States Minister Conger sends from Pekin the following clipping from the North China News of July 12, purporting to be a translation of a recent decree of the Emperor in regard to the enactment of copyright and patent laws.

It would appear from this decree, says Mr. Conger, that China is about to give her men of literary and inventive genius the same recognition and protection accorded them by other nations; and it is indicative of the great changes soon to take place in the country. Unfortunately, since the issuing of this statement by Mr. Conger affairs have taken an unfortunate turn in China, and it is impossible now to tell when the new laws will be enacted. It remains to be seen how far the Dowager Empress and Li Hung Chang will allow the measures of reform and reconstruction to be carried.

"The following important imperial decree, which is really the promise of the enactment of copyright and patent laws, was issued on July 5.

"From ancient times until now, the first duty of government has been to bring order out of chaos and shape the rough materials at hand. With the increasing facilities of international commerce, our country has been filled with an influx of scientific, mechanical, and artistic things which are an education to the masses, whose eyes are daily being opened to their usefulness. China is a great country, and our resources are multitudinous. Men of intellect and brilliant talent, capable of learning and doing anything they please, are not lacking; but their movements have hitherto been hampered by old prejudices which have formed a bar in thinking out and introducing to practical use new inventions. Now that we have entered upon the high-road toward the education and enlightenment of the masses, for the purpose of making our empire strong and wealthy like other nations, our first duty should be the encouragement and employment of men of genius and talent. We therefore hereby command that from henceforth, if there be any subject of ours who should write a useful book on new subjects, or who should invent any new design in machinery, or any useful work of art and science which will be of benefit to the country at large, he shall be honored and rewarded by us in order to serve as an encouragement and exhortation to others of similar genius and talent. Or, if it be found that such geniuses have real ability to become officials, we will appoint them to posts as a reward, or grant them decorations or fine raiment in order to show the masses the persons who have gained honor by their talents and genius; while they shall also be allowed to enjoy the fruits of their labors by being presented with papers empowering them to be the sole manufacturers and sellers within a certain limit of time. Again, to such as have administrative talents and the necessary funds either to build schools, or begin irrigation works for the benefit of agriculture, or build rifle factories or cannon foundries, all of which will be of great benefit to the population of the empire at large, shall be granted rewards on the same scale as men who have gained distinction in the army or navy, in order to give them special encouragement to work for the good of themselves and their country. We hereby further command the Tsungli Yamên to draw up the regulations which shall govern the various matters noted within this ediet, and report at once to us."

DEATH OF COLONEL WARING.

Just as we go to press it is our painful duty to record the death, on October 29, by yellow fever, of Colonel George E. Waring, Jr., at his apartments in New York city.

Colonel Waring contracted the dread disease while in the service of the government at Havana, so we must add one more name to the honorable roll of those who have died for their country as a result of the Spanish-American war. Colonel Waring was sent to Havana to give advice in his capacity of expert sanitary engineer, and he contracted the disease while devising means to drive the scourge from its home in Havana. We will give a biographical notice of Colonel Waring in our next issue.

An Explosion of Liquefied Air.

A serious accident with liquefied air occurred on October 21 at the Polytechnic Institute, Brooklyn, N. Y. Prof. Irving W. Fay, in trying an experiment with mixing liquefied air with red phosphorus, caused an explosion which injured him severely and also burned one of the students. The day previous to the accident, four gallons of liquefied air were taken to the Institute, and the next day Prof. Fay, who is head of the chemistry department, gave a lecture in which he tried all of the now classic experiments with liquefied air. After the lecture ended, half a dozen of the students remained to observe the professor try some original experiments. Kerosene, alcohol, and turpentine were among the objects experimented with, and they were frozen by the application of liquefied air. Yellow phosphorus was treated with liquefied air, which changed the phosphorus to a crystalline structure. The professor then determined to try red phosphorus, in the hope that liquid air might prove to be a solvent for it. He placed some of it in a beaker glass and poured the liquid air upon it. The mixture was then turned on a piece of paper lying on the table, and he bent over it to observe the result. The liquid air rapidly evaporated, and in a very short time there was nothing on the paper but a little pile of red phosphorus. The professor and students examined it eagerly to note the changes produced. After a moment the phosphorus became a lighter shade of red. The professor at first thought that the combination might have been changed to yellow phosphorus, but further examination led him to believe that it had become solid carbon dioxide, CO_2. While making these experiments, the professor stirred the phosphorus with a glass rod. Suddenly there was a terrific explosion, the glass in the windows was shattered, the room was filled with smoke, and the table broken. The professor gave a cry of pain and clapped his hands to his eyes. His face had been torn and burnt and his thumb nail torn completely off. Fortunately the explosion was a downward one, tearing a great jagged hole in the table, but for the nearness of Dr. Fay's face to the phosphorus he would have probably escaped without serious injury. Prof. Fay was attended by an eye and ear specialist, and it is hoped he will not lose the sight of one eye, as was at first thought.

This accident should sound a note of warning to those of our readers who are fond of chemical experiments. It is not safe to make combinations of chemicals at random. It is far better to try the older and well-established experiments. Only the carefully trained specialist should attempt to do new experiments, and even he should use the greatest possible care, and even though such care is taken, it is not always possible to avoid deplorable accidents like the one just described.

AN IMPROVEMENT IN CLEANING DEVICES.

To provide a device by means of which windows and walls may be effectively cleaned, the amount of water used being under the control of the operator, the brush illustrated in the engraving has been invented. Into the back plate of the brush screws the faucet of a hose. This faucet is provided with a plug by means of which the flow of water may be regulated. The faucet is also provided with lugs connected by means of a clamping screw with the eye of a socket secured to the operating handle. By the use of the clamping

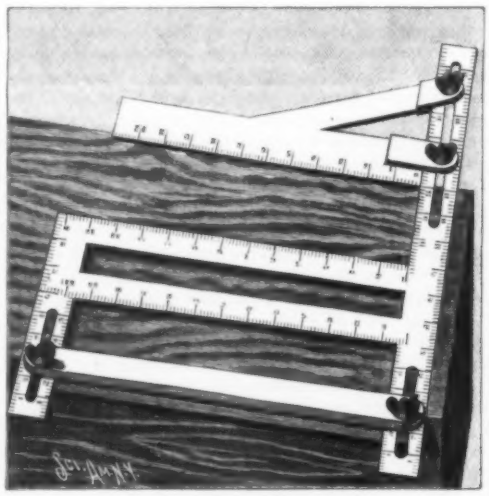
AN IMPROVEMENT IN CLEANING DEVICES.

screw the faucet-body can be moved in an angular position relatively to the handle, thus enabling the operator to apply the brush properly. Apertures are formed in the brush-back, so that the water flowing through the faucet-body may be directed through the apertures to the bristles of the brush and to the object to be cleaned, thus facilitating the removal of dirt. The brush is the invention of James R. Dever, of Olympia, Wash.

AN EFFICIENT FRAMING SQUARE.

A framing square has recently been patented by James H. White, of Ansonia, Ohio, by means of which a carpenter can lay out mortises and tenons on the top, side, or bottom of a piece of wood without the necessity of turning the timber.

As shown in the engraving, the framing square is pro-



WHITE'S FRAMING SQUARE.

vided with two graduated side arms of different lengths connected by a mortise and tenon bar. This mortise and tenon bar is formed with an aperture 1 inch in width, leaving the remaining two portions also 1 inch in width, so that the bar can be used in laying off 1-inch, 2-inch, or 3-inch mortises and tenons. To one slotted end of the long side arm a gage-plate, lying parallel with the mortise and tenon bar is adjustably secured and held in any position within the length of the slot by means of a clamping screw. The other end of the long side arm and the free end of the short side arm are slotted to receive the clamping screws of an adjustable head.

If it is desired to use the square for 7-inch timber and 2 inch mortises and tenons, the inner edge of the head is set 2 inches from that edge of the mortise and tenon bar lowermost in the engraving, and the gage-plate is set 2 inches from the edge of the mortise and tenon bar, uppermost in the engraving. The tenons as well as the mortises can then be laid out by placing the head against one side of the timber and drawing the mortise and tenon lines along the edge of the tenon bar lowermost in the engraving, and along the edge of the aperture of the mortise and tenon bar shown uppermost in the engraving. When set as described, the device can be readily used in laying off 1, 2, or 3-inch mortises 2 inches from the edges of the timber and of any desired length. The head is made adjustable, to enable the carpenter to lay off the mortise any desired distance from the edge or corner of the timber.

Turf Briquettes in Germany.

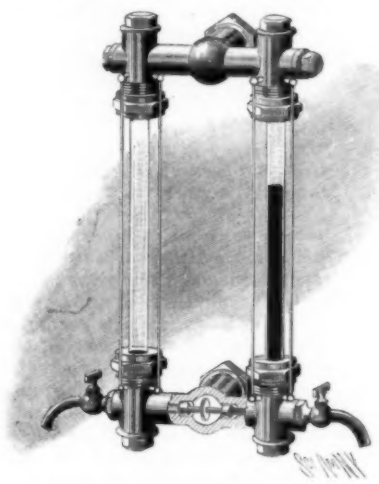
Consul Powell, of Stettin, in his last report, calls attention to a briquette factory at Langenburg, Pomerania, which is somewhat of a new venture, as it has only been in existence for two years, but has proved so far a complete success. It is the consul's opinion that proprietors of turf moors in Scotland and Ireland might start factories of a similar nature with profit. The owner and manager of the factory has taken a patent in England for his machinery; it could, therefore, be employed either by purchase or by royalty. The turf at Langenburg is cut from the adjacent moor and is brought by water in an undried condition, and can be used immediately. The turf on coming from the moor is thrown into the first breaker machine, somewhat in effect like a large turnip cutter, and in this it is broken into small lumps. From the first it passes to the second breaker, and is ground into mull or a fine powder. From here it goes into the drier, a steam cylinder which is filled with the exhaust steam from the engine, and is perforated by tubes much in the manner of boiler tubes, but larger. This cylinder revolves, and being on a gentle slope, the mull passes slowly through the tubes and by this means becomes thoroughly dry. From the drier it passes to a hopper which feeds the plunger. This plunger receives the power of a 75 horse power engine, and by pressing the mull in a form against the preceding briquettes pushes them forward each stroke the width of a briquette.

The factory turns out 80 briquettes a minute, or 35 tons per day, with an average output of about 255,500 centners (12,775 English tons) a year, and the demand is far greater than the supply, the reason for this being that the briquettes are so marvelously cheap—an average price being 13 cents per 130 briquettes, or at the rate of something like two briquettes for ¼ cent retail—that this is certainly the poor man's fuel, as they burn slowly and give a fairly good heat. In a closed oven one briquette will remain in a glowing state for twenty-four hours; in an open grate it burns more quickly, but remains for a longer time alight than any coal, giving a good red heat. The cost of working is comparatively light, as but few men are required to attend to the machinery. The cost at Langenburg of material and working one centner (112 pounds) is 35 pf. (9 cents), and per ton about $1.75. With a more extended plant the owner of this factory is of opinion that this could be reduced to $1.25 per ton.—Journal of the Society of Arts.

A SAFETY GAGE-GLASS.

It is the purpose of an invention patented by John McCormick, of Wilmerding, Pa., to provide a gage arranged to cut off water and steam automatically should the gage-glass be broken, and to make a connection with a second glass.

The gage is provided with two glasses joined above and below by tubular connections communicating with the steam and water compartments of the boiler. Both tubular connections have valve-casings and outlets leading from the glasses. In the valve casings, double valves slide which may be seated on valve-seats in the outlets. By referring to the illustration, it will be seen that when the valves are seated in one outlet, the seats in the other outlet are uncovered. On the outlets of the lower tubular connection faucets are arranged, by means of which faucets communication may be automatically established between one of the glasses and the water compartments of the boiler. Should it be desired, for example, to use the right hand glass, then the left hand faucet is for an instant opened, causing the escaping water to shift the valve upon the seats in the left hand outlets and shut off the water from the left glass. Communication will then be established between the upper and lower tubular connections and the outlets of the right hand gage-glass. Should this right hand gage-glass be broken, then the outrushing



McCORMICK'S SAFETY GAGE-GLASS.

steam and water will be automatically cut off by the shifting of the valves on the seats in the right-hand outlets. The seats in the other outlets being uncovered, communication will be established between the tubular connections and the left hand glass. The broken glass may then be removed and replaced by a new one.

A Magnetic Survey of the Globe.

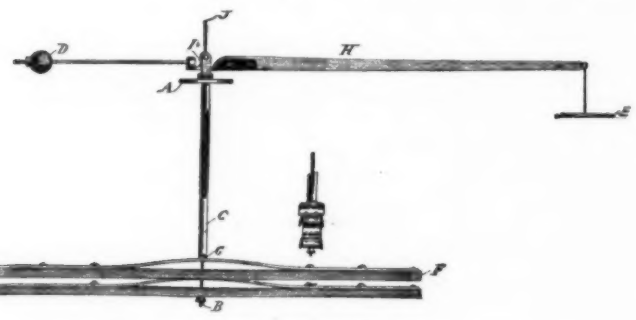
A meeting of scientific men has just concluded its labors at Bristol, England, in connection with the British Association for the Advancement of Science. The body was composed of leading authorities on the study of terrestrial magnetism and included some of world-wide reputation. Magnetic surveys of the United States are by law intrusted to the Coast and Goedetic Survey, so that the United States was represented by Charles A. Schott of the Survey. The questions for deliberation before this body concerned the preparation of a plan for a systematic magnetic survey of the entire globe, and the deliberation of the conference resulted in a general recommendation for that purpose. The principal work of the conference centered in the wider questions involving magnetic observations; their, at present, unsatisfactory distribution over the globe, and their inadequacy as regards numbers. The United States is in a position to take a most important step in the advancement of our knowledge of terrestrial magnetism by establishing and maintaining a well-equipped magnetic observatory on one of the Hawaiian Islands. Their position is unique, being central to a vast unexplored or rather magnetically unknown region and well adapted for the special study of the modifications which the diurnal and secular variations of the magnetic needle are supposed to undergo in consequence of a surrounding ocean as contrasting with a continental surface. The president of the conference, Prof. Rucker, complimented the Coast and Geodetic Survey upon their valuable services.

CYPHERS INCUBATORS.

In all methods of incubation, the prime requisites are effective means for the regulation of heat and for the supply of fresh air. Heat by its action arouses life in an egg; pure air furnishes the oxygen by means of which necessary chemical changes are produced.

In natural incubation the bird, under normal conditions, maintains in the eggs the constant temperature required in hatching out the chicks. When this temperature loses its uniformity and the eggs are subjected to extremes of heat and cold, the embryo dies. The conditions under which a bird can successfully hatch are therefore limited. In endeavoring to effect by artificial means what a bird accomplishes by natural means, it is of the utmost importance to provide some mechanical device by means of which a reasonably uniform temperature can be automatically maintained. It is furthermore essential that the heat be uniformly distributed and that proper means of ventilation be provided. These exacting conditions seem to be most satisfactorily fulfilled in an incubator made by the Cyphers Incubator Company, of Wayland, N. Y.

A CYPHERS INCUBATOR.



THE REGULATOR.

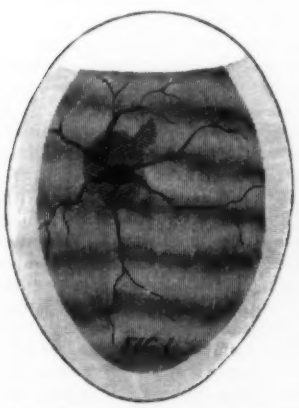
The first requirement—the provision of an automatic heat-regulating device—is met in the Cyphers incubator by a positively acting, sensitive thermostat, composed of aluminium and steel. Referring to our illustrations, it will be observed that the thermostat, *F*, is connected by means of a rod, *J*, inclosed within a brass tube, *C*, and passing through a cast head, *A*, with a lever, *H*, mounted on knife-edge bearings. A counterpoise, *D*, is adjustably secured to one end of the lever, and a disk, *E*, is attached to the other end of the lever and hung over the heater. As the temperature within the incubator rises above the degree desired, the aluminium, expanding more than the steel, is thrown toward the center by the use of sliding rivets, and assumes the bow-like form indicated in the illustration. The expansive force of the metal being transmitted to the connecting rod, *J*, causes the lever, *H*, to operate the disk, *E*, so that the heat may be regulated to conform with the required temperature.

In order that the second condition—the uniform distribution of the heat—may be fulfilled, the manufacturers of the Cyphers incubator have devised a system according to which the warm air coming from the heater is first passed over and through a diaphragm into the hatching chamber, thence to be conveyed downwardly around the eggs and through a double porous diaphragm placed above a shallow chamber in the bottom of the incubator. After passing through the second diaphragm, the warm air, now impregnated with poisonous gases thrown off by the eggs, is conducted out of the incubator. The fresh, warm air, it will be observed, is evenly distributed over the whole area of the hatching chamber before entering. The downward movement is slow and positive, thus permitting the use of a larger volume of air than is employed in most incubators.

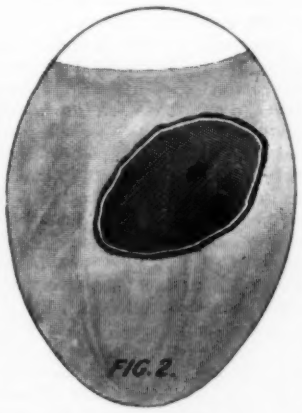
By means of the system of diffusive ventilation employed in the Cyphers incubators, the use of supplied moisture is rendered unnecessary. The Cyphers incubators provide their own moisture.

The old systems of incubation requiring supplied moisture cause many chicks to die in the shell—a feature that has proved to be very annoying to old and new breeders alike. The system of diffusive ventilation employed in the Cyphers incubator, however, and the absence of the necessity of using supplied moisture, overcomes this perplexing problem. Chicks and ducklings break their shells properly and come out strong and active, making hardy birds that will live and thrive.

Below the egg trays is located the nursery, in which the chicks or ducklings are deposited after having been hatched out. By disposing the hatched chicks in this manner, those not yet clear of the shells are permitted to continue their development undisturbed.



A FERTILE EGG AFTER THE SIXTH DAY.



A DEAD GERM.

The Coast Signal Service.

The interesting report on the operation of the United States Coast Signal Service during the war, by Capt. John R. Bartlett, U. S. N., has been recently published. The plan of the work was laid out by a board appointed last year, but the exigencies of the service caused rapid changes. Eighteen stations were established on the coast from Massachusetts to Louisiana. These stations were manned by a total of 310 men. Each station was furnished with a 90-foot mast and 40-foot yard. Flags and other signal devices, telephones, torches, and lights were furnished. The value of the service was greatly increased by the cooperation of the crews in the life saving stations and the lighthouse keepers. The Weather Bureau observers also assisted; 1,443 life saving crews, 850 lighthouse keepers, and 33 Weather Bureau observers kept watch over the coast. Ordinarily, life saving crews are laid off usually in June and July, but a bill was passed to keep the majority of the stations open the whole year. All of the stations were connected with the telegraph system, and immediate right of way was arranged for in case of an emergency. Repeated tests were made which showed that the whole system could be put in communication with the Washington office in half an hour. Extensive preparations were made for notifying adjacent auxiliary naval forces, forts, and batteries directly from the stations. Lamp signals were particularly interesting, because of the use of acetylene gas. Pigeons were not used, but a trained service of this kind is recommended.

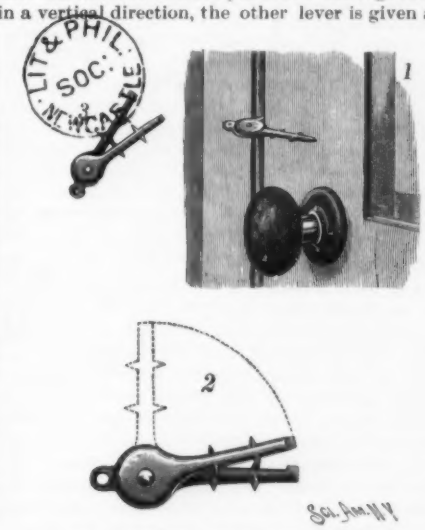
The results of all the work are summed up by Capt. Bartlett as follows: From the practical operation of the Coast Signal Service for three months he is confident that it would have served the use for which it was established—to observe and report the approach of the enemy's vessels. It frequently served an excellent purpose in keeping the Navy Department advised of the movements of the United States vessels, and was particularly serviceable in several stations, such as reporting to and putting the department in direct communication with the "Oregon" after her long run from the Pacific, while the whole country was anxious for news of her, also when the "San Francisco" needed assistance and quick correspondence with Washington. It was also useful in keeping the various navy yards advised of the approach of the vessels, thus giving them advance notice of their arrival, and in many cases this information was given so as to enable them to make extensive preparation for the reception of these vessels. Some of the stations were also able to render valuable assistance to the quartermaster's department of the army in keeping them in close touch with the hospital and supply ships and the transports, and by sending messages to them when they were in the offing. Capt. Bartlett is of the opinion that the Coast Signal Service should be an integral part of a naval coast defense system, as it is most intimately connected with it and should be in closer relation than that of an allied branch, also that the personnel of this service can be entirely furnished by the men who have been trained in the State naval militias. They have proved in their recent experiment to be well disciplined, trustworthy, competent, and zealous. Another valuable result of the experiments has been to demonstrate the great usefulness of the life-saving stations for the purpose of observation and international code signaling, and to show that the lighthouses are almost instantly convertible in an emergency into quarters and signal towers. The cost of the work done from April 22 to September 30, inclusive, is $73,198.

A KEY WHICH WILL LOCK ANY DOOR.

In the accompanying illustration we present a novel key made by the White Manufacturing Company, of Ithaca, N. Y., which key is so constructed that with its aid any door, window, or transom can be securely locked.

As shown in Fig. 3, the key comprises two levers pivoted on each other. Formed at right angles to the shanks of the levers are tapered lugs lying in the plane of the levers.

In order to lock any door by means of this key, it is necessary merely to arrange the levers perpendicularly to each other in the manner shown by dotted lines in Fig. 2. The shank of one lever having been inserted between the door and the jamb with the lugs extending in a vertical direction, the other lever is given a quarter turn in order to force the lugs horizontally into the jamb and into the door. Thus applied, the key will lock any door as effectually as a strong lock.



A KEY WHICH WILL LOCK ANY DOOR.

A key of this pattern will be found of use to those who are frequently compelled to occupy sleeping rooms the doors, transoms, and windows of which cannot be securely locked.

The key is but 2¼ inches long, weighs less than one ounce, and can be carried on the key ring or in the pocket-book.

A Pyro Developer and a Toning Solution.

Mr. T. Hopper sends the following formulas:

Water	12 ounces by weight.
Sodium carbonate	1 " " "
Sodium sulphite	2 " " "

Keep the above solution in a well stoppered bottle. To develop take:

Water	3 to 4 oz.
The above solution	1 "
Dry pyrogallic acid	8 grs.

It is very convenient to have the pyrogallic acid done up in powders of 8 grs. each. These must be kept in a wide mouthed bottle which is well stoppered. The following is a cheap toning solution which can be used for toning proofs, etc.:

Soda hyposulphite	1 part.
Vinegar	1 "
Water	4 "

When toned to the desired shade, drop into salt water for five minutes and wash thoroughly.

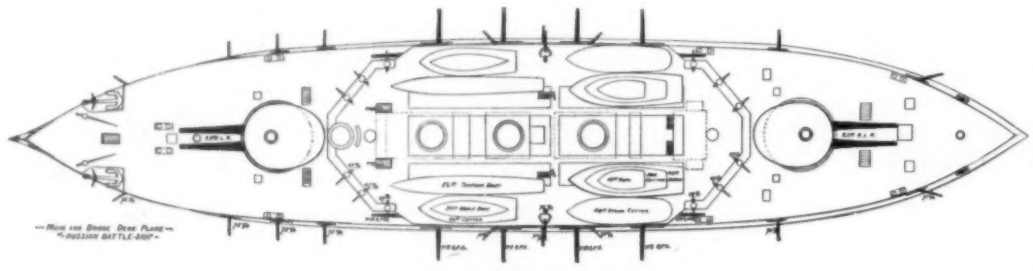
AN international exhibition of postal cards was held in Zurich, Switzerland, during September, 1898. More than two thousand different cards with views of Switzerland were exhibited.—Uhland's Wochenschrift.

AMERICAN-BUILT WARSHIPS FOR THE RUSSIAN NAVY.

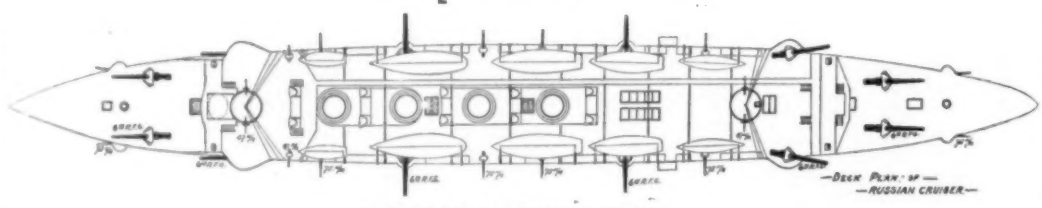
Fifteen years ago, when the United States undertook the task of creating a new navy, it found itself equipped with but few of the tools and less of the experience necessary for the costly and intricate art of warship construction. It was starting in a race in which its competitors had a start of nearly a quarter of a century. Few indeed, at the date of its birth, would have ventured to assert that within a decade and a half it would stand fourth among the great navies of the world, surpassing the fleets of Germany, Italy, and Spain in size and equaling that of Great Britain in efficiency.

Next to the test of actual war, no stronger indorsement of the excellence of a nation's warships can be desired than the fact that its shipbuilding yards are patronized by foreign governments, especially if the orders include the highest type of ships in the shape of first-class cruisers and battleships. It is well understood that the task of building a modern battleship involves such a vast and costly plant, and the exercise of such a high order of technical skill, that it can only be accomplished by a comparatively few shipbuilding yards whose plant and working staff are of the most elaborate and perfect description.

The first foreign orders for warships of the modern type were those given by the Japanese government to the Union Iron Works, of San Francisco, and the Cramps' Shipbuilding Company, of Philadelphia, for two high speed cruisers. These vessels, which were described in an illustrated article in the SCIENTIFIC AMERICAN for July 3, 1897, have been built and tried, both of them with highly satisfactory results. Following closely upon the successful trial of these ships has come an order to the Cramps' yard for the construction of two first-class ships—a battleship and a cruiser—for the Russian government. By the courtesy of the contractors we are enabled to give the accompanying illustrations of the vessels as they will appear when completed, together with the following details of their construction and equipment.



DECK PLAN OF RUSSIAN BATTLESHIP.



DECK PLAN OF RUSSIAN CRUISER.

THE 12,700-TON BATTLESHIP.

Taking the battleship first, as being the more important, we find that she is an exceedingly handsome vessel, with all the characteristic points of the most modern type. Half battleship, half cruiser, it is difficult to say whether she truly belongs to the one class or the other. She has the size, armor, and armament of the battleship, with the speed, coal capacity, and wide radius of action of a cruiser. Her principal dimensions are as follows:

GENERAL DIMENSIONS.

Length between perpendiculars	376 feet.
Breadth	72 feet 2⅓ inches.
Displacement (approximate)	12,700 tons.
Draught, not to exceed	26 feet.
Speed at full displacement for 12 hours	18 knots.

The Russians, like the French, have hitherto rather favored a continuous belt of side armor at the waterline; but in the new vessel they are adopting the partial belt which characterizes the British ships and our own. The belt will extend for two-thirds of the vessel's length and will be 9 inches in thickness up to the level of the protective deck. Associated with this will be a protective deck 2 inches thick on the flat and 4 inches on the slopes. These slopes will start at the level of the top of the 9-inch belt and descend to a junction with the bottom of the belt below the waterline. The space between slope and belt will be occupied by the coal bunkers, so that to reach the engine or boiler rooms a projectile would have to penetrate 9 inches of Krupp steel, from 6 to 10 feet of coal, and 4 inches of sloping Krupp armor. The coal would equal in resistance about 3 inches of steel and the 4-inch slope would equal 6 inches of vertical steel, thus giving a total resistance equal to a single vertical belt of 18 inches of steel, which is the thickness carried by our vessels of the "Oregon" class.

The protective deck, of course, extends the full length of the vessel, curving down to meet the stem and stern. At the stem it is merged into the framing of the ram bow, and serves both to stiffen the ram and transmit the shock of impact to the whole structure of the vessel. Above the 9-inch belt amidships and between the protective and the gun decks is worked another belt of 6-inch armor, which will prevent rapid-fire shells from penetrating and bursting beneath the guns on the gun deck above.

The gun deck carries the bulk of the rapid-fire armament. Amidships, above the 6-inch belt referred to, is a battery of eight 6-inch rapid-fire guns, mounted in broadside, with a considerable train forward and aft. The casemates through which these guns are fired are protected by 5 inches of steel, and protection is afforded against a raking fire by complete athwartship walls of armor. It should be mentioned that the 9-inch belts are also continued athwart the ship to form bulkheads for the protection of the engine and boiler rooms. Forward of the central battery on the same deck are eight 3-inch rapid-firers, and aft of the battery are four other guns of the same caliber.

The upper or main deck is flush throughout the ship, except where it is occupied by the amidship superstructure. Forward and aft of the superstructure are two elliptical turrets each of which will contain a pair of high-powered 12-inch rifles. Within the superstructure, one at each angle, and commanding a wide range of fire from dead ahead to well abaft the beam, will be four 6-inch guns protected by Krupp armor. Between these on the broadside will be half a dozen of the effective little 3-inch rapid-firers.

One would think that this was armament enough to suit even a Russian battleship (for the Russians, like ourselves, are firm believers in the advantages of a crushing gun-fire); but there are yet thirty-four guns to be accounted for, and these will be found on the boat deck, the bridge, and the fighting tops. Two 3-inch guns are mounted amidships on the boat deck, one on each broadside; six 1⅜-inch rapid-firers are mounted forward and another half dozen 1⅜-inch aft on this deck, while yet another dozen are mounted on bridges above these. Elsewhere are two 2½-inch rapid-firers, while from the tops half a dozen 1½-inch rapid-firers will add their storm of shells to the awful hail that will be poured forth from the bridges and boat decks below. The armament is completed by no less than six torpedo tubes.

How the problem of supplying projectiles simultaneously to some seventy rapid-firing guns has been worked out we are unable to state; but we are assured by the contractors that full provision has been made for every gun.

The ship will be driven by triple expansion engines and steam will be supplied by Niclausse water-tube boilers of a combined capacity of 16,000 horse power, and this vessel will be the first battleship built in this country having a complete installation of water-tube boilers and machinery particularly adapted to the water-tube boiler. It should be mentioned that the turrets will be operated by electricity; in fact, many of the auxiliary machines usually operated by steam will on this vessel be driven by electric motors.

In the features of drainage, ventilation, the comfort of the officers and crew, this ship will be more than abreast of current practice in naval equipment. The requirements of the trials for speed, the amount of ammunition, and the various guns to be carried and adequately protected, together with the large amount of stores and outfit to be provided for, make the fulfillment of these conditions possible only to a company like that of the Messrs. Cramp, whose long and successful experience in designing and building vessels of war gives ample assurance that these difficult requirements will be fully met.

THE 6,500-TON CRUISER.

The new cruiser will have the same characteristic features of speed, heavy armament, and radius of action that are conspicuous in the battleship. Her principal features are as follows:

GENERAL DIMENSIONS.

Length between perpendiculars	400 feet.
Beam	52 feet.
Draught, about	19 feet 6 inches.
Displacement, about	6,500 tons.
Speed for 12 hours	23 knots.

Battery: Twelve 6-inch rapid-fire guns; twelve 3-inch rapid-fire guns; six 1⅜-inch rapid-fire guns; four torpedo tubes.

The protective deck will be 1½ inches on the flat and 3 inches thick on the slopes.

The main battery of 6-inch guns is carried as follows: Four amidships on the main deck in broadside; two forward and two aft on the main deck mounted in sponsons so as to command a dead ahead and dead astern fire; two bow chasers on the forecastle deck and two stern chasers on the quarter deck. There is thus a concentration of the fire of four 6-inch guns forward, four aft, and six on either broadside. There are also two 3-inch rapid-fire guns forward and four amidships on the main deck and two 3-inch rapid-firers aft on the berth deck. Six 1⅜-inch rapid-firers are carried on the bridge and in the two tops. There are four torpedo tubes.

As in the battleship, the cruiser's boilers will consist entirely of the Niclausse water-tube type. Attention is directed to the unprecedented conditions of trial for this ship, the high speed of 23 knots an hour having to be maintained for twelve consecutive hours. The same long period of full power test is exacted in the case of the battleship, and it is certain that, if the Messrs. Cramp can successfully fulfill these severe requirements, the result will revolutionize the conditions of future speed trials.

Judged from the standpoint of appearance, it must be admitted that these vessels will be remarkably handsome specimens of the naval shipbuilder's art.

An Accident on the London Underground Electric Road.

A few days ago Londoners were alarmed by an accident which occurred on the new electric underground road. There had been a great crowd at the Waterloo Station to welcome home the Guards from their campaign in the Soudan. Afterward there was a rush of people to the City, and naturally the new electric line came in for a considerable part of the traffic. It was crowded to its utmost capacity, and the electric power proved inadequate to carry the overloaded trains up the heavy grade from beneath the river to the City terminus, and the result was the cars stopped. The electric lights became dim, but there was no uneasiness among the entombed passengers. In a few minutes, however, the air became heavy, and while there were no choking odors such as are familiar to passengers on the other underground London lines, still there was a peculiar sensation of suffocation which resulted in almost a panic. Opening doors and windows did no good, for the tunnel itself was very little larger than the cars themselves. The passengers left the cars and made their way with considerable difficulty through the narrow space on each side between the trains and the walls of the tunnel until they finally reached the City terminus, about a quarter of a mile distant.

The theory of the deep underground electrical railways is that no ventilation is necessary beyond that automatically provided by the motion of the trains themselves. Experiments seem to justify this theory, and no serious difficulty had been experienced until the present time, and it would really seem that in a very short line like the City and Waterloo Railway no artificial ventilation would be necessary, but there is no question that the danger really exists even in this short line, and undoubtedly some means will be provided for supplying air to victims of such mischance as that above described.

EFFECTS OF THE ARC ON EYES.—The report of Tracinski, in the Zeitschrift für Beleuchtungswesen (April 30), gives the result of investigations in connection with the operation of the Zerener arc welding process, which is now coming into use quite largely. The operator wears a pair of spectacles of dark, smoked glass, besides which he looks through a pane of deep red glass, which is connected with the apparatus. The action of the light is sufficiently reduced by this means, says The Progressive Age. He tried using the red glass alone, but it affected the eyes for some time after. The workmen who are using this apparatus continuously at first experienced pain in the eyes at night, but later on this disappeared; the sight, however, was not affected. He concludes that no permanent ill effects are produced if proper precautions are taken, and if the operator becomes gradually accustomed to the work. It is a mistake to have a new operator work a whole day with the arc, as he should begin with a few hours a day until his eyes have been accustomed to it. Only those who have healthy normal eyes should attempt this work.

Correspondence.

The Light of the Firefly.

To the Editor of the SCIENTIFIC AMERICAN:

The light emitted by the firefly has always been an object of interest by reason of the small amount of energy apparently required to produce it. It has been one of the dreams of the scientific man to rival this light in efficiency, even if no practical use followed. In this connection a short summary of what is known upon the subject may not be out of place.

The first inquiry naturally suggesting itself is as to the character of this light as compared with light from other sources. It has been found that the light of glow-worms contains photographic rays which will pass through aluminum. It has also been found that the rays emitted by fireflies, after filtration through cardboard or through copper plates, will act photographically, and are capable of reflection and probably refraction and polarization. This would indicate the presence of rays belonging to the extreme ultra-violet end of the spectrum, since it is known that these extreme ultra-violet rays have the power of passing through bodies opaque to the longer wave lengths visible to the eye. If this is so, they are probably the same as the invisible rays emitted by uranium and its salts, which have the power of passing through aluminum and cardboard and are capable of reflection, refraction, and polarization. These are known as Becquerel's rays. In short, therefore, we may say that the light of the firefly contains invisible photographic rays from the extreme violet end of the spectrum, in addition to the ordinary light rays.

Turning now to the construction of the light-producing apparatus, it has been found by Max Schultz that this organ in the glow worm consists of a pale, transparent, superficial layer, which gives off the light, and a deep opaque layer, whose function is less obvious. The Italian firefly, in which both male and female are luminous, has been examined by Emery. Here, as in the glow worm, the organ was found to consist of two layers. It has also been found that the ultimate branches of the tracheæ or air tubes are distributed through the photogenic apparatus; nerve fibers are also present. The luminous organ in the firefly is regarded as homologous to the "fat body" often found in insects.

Now directing attention to the cause of the light, we are met by two very significant discoveries, first, that carbonic acid extinguishes the light, and, second, that oxygen intensifies it. These facts, in conjunction with the known distribution of air tubes in the photogenic body, point very strongly to the theory that the light is the result of some form of slow combustion, while the fatty nature of the luminous cells indicates the probability of fat, with some form of free phosphorus, as the active agent.

It may be added that, as regards light-producing animals in general, it has been found in a large number of them that the luminous organs retain their power after death and even after desiccation and subsequent moistening. There would therefore seem no reason to adopt the theory that we have here to deal with any direct transformation of vital into radiant energy. The most probable explanation of the phenomena, at least in the firefly and glow worm, is that it is the result of slow combustion.

And yet, even granting this is the cause of the light, there remains still to be explained why this form of slow combustion produces these extreme ultra-violet rays while other forms of combustion do not. There is some underlying mystery of molecular physics here well worth investigation. C. M. BROOMALL.

Media, Pa.

Avoid Coughing.

A physician who is connected with an institution in which there are many children, says: "There is nothing more irritable to a cough than coughing. For some time I had been so fully assured of this that I determined for one minute at least to lessen the number of coughs heard in a certain ward in a hospital of the institution. By the promise of rewards and punishments I succeeded in inducing them simply to hold their breath when tempted to cough, and in a little while I was myself surprised to see how some of the children entirely recovered from the disease. Constant coughing is precisely like scratching a wound on the outside of the body; so long as it is done, the wound will not heal. Let a person when tempted to cough draw a long breath and hold it until it warms and soothes every air cell, and some benefit will soon be received from this process. The nitrogen which is thus confined acts as an anodyne to the mucous membrane, allaying the desire to cough and giving the throat and lungs a chance to heal."

ACCORDING to Elektrotechnische Rundschau, underground cables sheathed in glass tubes have been tried successfully at Marseilles, France. The insulation is very reliable, and, the glass tubes being air-tight, the cables are thoroughly protected from dampness.

Miscellaneous Notes and Receipts.

Removal of Rust Spots.—To remove rust spots from stuffs the following methods are recommended: 1. Moistening with potassium cyanide. 2. Soaking in solutio sodium pyrophosphate. 3. Moistening with stannic chloride and immediate washing after the disappearance of the spot. 4. The best and cheapest: Take a bright piece of galvanized iron, lay it on a pot with boiling water, put the wet material with the rust spot on top, dab the spot with diluted sulphuric acid and rub out with the finger. The spot will disappear in a few seconds; after that, wash immediately with ordinary water. Instead of sulphuric acid, oxalic or tartaric acid may be employed.—Neueste Erfindungen und Erfahrungen.

To Deodorize Petroleum and Benzine.—To mask the unpleasant odor of petroleum, etc., an addition of 1 per cent of amyl-acetate is recommended. To destroy the nasty smell of benzine, and at the same time render the benzine colorless, Berninger proceeds as follows: To a mixture of ¼ liter of sulphuric acid and 1·75 liters of water add, after cooling, 30 grammes of potassium permanganate, next mix with 4·5 liters of benzine and allow to stand for 24 hours, shaking occasionally. After this period the benzine is lifted off and agitated for several hours with a solution of 7·5 grammes of potassium permanganate and 15 grammes of sodium carbonate in 1 liter of water. The separating benzine is said to be odorless and colorless, without having to be again distilled.—Wiener Drogisten Zeitung.

Artificial Caoutchouc.—An artificial product, which for certain purposes can take the place of India rubber and gutta percha, is obtained by mixing oxidizable vegetable oils (linseed oil, cotton-seed oil, palm oil, etc.) with tar, creosote, or wood vinegar. Melted or pulverized shellac or shellac solution may, besides, be added. Next the mixture is treated with diluted nitric acid and a non-viscid, elastic, tough product is obtained which can be vulcanized.

According to another, somewhat modified process, the mass is exposed to the action of nitric acid for a short time only and then heated on plates. The artificial caoutchouc is used either alone or mixed with natural caoutchouc, and is chiefly employed as an insulating material for electric conduits and for waterproofing fabrics.—Deutsche Malerzeitung.

Transparencies.—As regards the London transparencies, which are exceedingly handsome and very useful for various purposes, the Papier Zeitung gives some interesting information, from which we cull the following technical details:

White paper is coated with a liquid whose chief constituent is Iceland moss strongly boiled down in water to which a slight quantity of previously dissolved gelatine is added. In applying the mass, which should always be kept in a hot condition, attention should be paid to cover the paper uniformly throughout. After it has been dried well, it is smoothed on the coated side and used for a proof. The transparent colors to be used must be ground in stronger varnish than the opaque ones. In order to produce a handsome red, yellow lake and red sienna are used; the tone of the latter is considerably warmer than that of the yellow lake. Where the cost is no consideration, aurosolin may also be employed. For pale red, madder lakes should be employed, but for darker shades, crimson lakes and scarlet cochineal lakes. The vivid geranium lake gives a magnificent shade, which, however, is not at all fast in sunlight. The most translucent blue will always be Berlin blue. For purple, madder purple is the most reliable color, but possesses little gloss. Luminous effects can be obtained with the assistance of aniline colors, but these are only of little permanence in transparencies. Light, transparent green is hardly available. Recourse has to be taken to mixing Berlin blue with yellow lake or red sienna. Green chromic oxide may be used if its sober, cool tone has no disturbing influence. Almost all brown coloring bodies give transparent colors, but the most useful are madder lakes and burnt umber. Gray is produced by mixing purple tone-colors with suitable brown, but a gray color hardly ever occurs in transparent prints. Liquid siccative must always be added to the colors, otherwise the drying will occupy too much time. After the drying, the prints are varnished on both sides. For this purpose a well covering, quickly drying, colorless, not too thick varnish must be used, which is elastic enough not to crack nor to break in bending.

Frequently the varnishing of the placards is done with gelatine. This imparts to the picture an especially handsome, luminous luster. After an equal quantity of alcohol has been added to a readily liquid solution of gelatine, keeping it ready in a zinc vessel, the gelatine solution is poured on the glass plates destined for the transparencies. After a quarter of an hour, take the placard, moisten its back uniformly, and lay it upon the gelatine film, which has meanwhile formed on the glass plate, where it remains two to three days. When it is to be removed from the plate, the edge of the gelatine film protruding over the edge of the placard is lifted up with a dull knife, and it is thus drawn off while a fine, transparent gloss has remained on the placard proper. In order to render the covering waterproof and pliable, it is given a coating of collodion, which does not detract from the transparence. The glass plates and their frames must be cleaned of adhering gelatine particles before renewed use.

Science Notes.

Through the generosity of Mr. Cornelius Vanderbilt, says Science, the New York Botanical Garden is about to undertake a botanical exploration of the island of Porto Rico. The expedition, which is now being organized, will leave for the new colony within a few weeks, and will carry on collecting of museum and herbarium specimens and living plants for at least six months. Inasmuch as very little is yet known concerning the natural flora of the island, it is confidently expected that much of value and interest will be secured, and the collections will furnish the basis of a report on the botany and vegetable productions of our newly acquired territory.

In Austria 5,578 patents were granted in 1897, of which only 1,795 were issued to Austrians, 262 to Hungarians, and 4 to residents of Bosnia and Herzegovina; that is, 2,061 to subjects of the Austro-Hungarian monarchy. The remainder, 3,517, were taken out by foreigners. Of these, Germans were most numerous, viz., 1,804, Americans were second with 462, British subjects third with 408, and French fourth with 365. The greatest number of patents in one class was in carriages and harness, which includes cycles, 536 patents being granted in this class. In electrical apparatus the number of patents was 297, in household articles 268, in manufacture of gas and gas lighting 231. Nine hundred and seven of the entire number, or 16 per cent, were secret patents.—Wiener Gewerbe Zeitung.

There are a great number of curious superstitions as to the time of day when a dying person is most likely to draw his last breath, and the tide, the moon, and the wind have all been supposed to have some share in the matter. According to The British Medical Journal, Raseri, who has analyzed 25,474 cases of death and 36,515 of birth, where the exact time of day was noted, finds that the maximum number of deaths occur in the early afternoon (2 to 7 P. M.) and the minimum in the last hours before midnight, while the maximum number of births occur in the early hours of the morning and the minimum in the early hours of the afternoon. As regards the cause of this, he points out that the hours of the maximum number of deaths are precisely those when the pulse rate and temperature are at their highest in health, and when there is a febrile exacerbation in illness.

Persons who rely upon domestic filters to purify water for household use will be interested to learn that, on the authority of the State Board of Health of Maryland, such filters may steadily lose efficiency until they become first-rate culture beds for bacteria, says The Sanitarian. An example cited is that in the case of a man in Baltimore who sends the whole water supply of his house through a large filter, and subsequently puts his drinking water through one of the small domestic filters common in the market. A test showed that, on a day when the city taps were running 510 bacteria to the cubic centimeter, the large filter was delivering 9,900 bacteria in the same quantity of water. When the large filter was repacked, only nine bacteria per centimeter got through it, but this same water when passed through the small filter came out with seventy-one bacteria per centimeter. A further example cited is from the office of the Baltimore Health Department, where a filter, supposed to be the best in the market, was in use. The effectiveness of that filter was so shortlived that the precaution was observed of boiling the water after it was filtered.

A report on the "further developing" schools of Saxony has been made to the State Department by Consul Monaghan, of Chemnitz. With a population of 3,783,014, the kingdom has 1,953 of these schools, with 75,358 boys and 1,699 girls in attendance. Besides these there are 39 higher industrial schools, with 10,660 scholars; 112 industrial technical schools, with 10,119 scholars; 44 commercial schools, with 4,781 scholars; 11 agricultural schools, with 691 scholars; 7 schools of all kinds of work for girls, with 1,569 scholars, and 18 technical schools for girls, with 2,445 scholars. Saxony's wonderful wealth, continues Mr. Monaghan, her industrial greatness, and the fact that she sends out to other parts of the world millions of dollars' worth of all kinds of wares, toys, textiles, tools, and machines attests the importance of these schools. To explain just what is meant by the term "further developing," the consul adds that the system of common school education under which boys and girls were given an ordinary training up to their fourteenth year was found inadequate. Compulsory education was established for graduates of the common schools. The hours of attendance are early in the morning or a certain number of afternoons each week. Manufacturers, merchants, etc., are made responsible for the attendance of the boys in their employ, and the latter make a special study of the trade in which they are occupied.

VIEWS FROM MOUNT TAMALPAIS, CAL.

Through the courtesy of Mr. Otto von Bargen, of San Francisco, we are able to present to our readers some interesting cloud studies taken from the summit of Mount Tamalpais. The trip is described by Mr. Von Bargen as follows: Two companions and myself made a trip to the mountain June 19 and again June 26, a week later. We left San Francisco with the 11:30 P. M. boat, arriving at Alto at the foot at 12:30, from there walking up and arriving at the top at about 3 A. M., by way of Mill Valley and the trail, returning to the city in the afternoon.

SUNRISE FROM MOUNT TAMALPAIS.

On both of these occasions the country below was covered more or less with fog, with the summit perfectly clear, which happens very often in summer time, and the photographs were taken shortly after sunrise, before any haze could rise. It was so clear above the fog that the summits of the Sierra Nevada Mountains, 155 miles to the east, were plainly visible.

On the occasion of the first trip, after having taken the photographs, and being then on the very peak, on looking to the west, we saw a most remarkable phenomenon—the shadows of ourselves thrown clear and distinct on the fog flying in front of us in the heavy wind that was blowing (the fog had risen by this time), with a beautiful colored corona around our heads. This lasted for about 15 minutes, when the fog closed in on the whole top of the mountain, shutting off the view. On the second trip the fog was lower, and in descending we saw at the fog line a beautiful white fogbow.

We were much impressed at the difference in the meteorological conditions between the country below and the top of so comparatively low a mountain (2,600 feet) as Tamalpais. On our first ascent, down below it was calm, while at the top there was a regular gale blowing; on the second ascent it was the reverse, windy and cold below, and warm with not a breath of wind blowing above. In summer the Weather Bureau report from Mount Tamalpais often shows a temperature of 90° and over when below it is between 50° and 60°.

Two German investigators, MM. Einhorn and Heintz, have lately discovered a new anæsthetic which they call "orthoform," says the Revue Scientifique. It belongs to the group of aromatic amidoethers, and is a light crystalline white powder, tasteless, odorless, and of weak solubility. With acids it forms soluble salts which are also anæsthetic, but too irritating to be employed locally on mucous membranes. Applied in powder or ointment to a wound or raw surface, orthoform renders them insensible—a fact confirmed by repeated clinical observation. In extensive burns, especially, orthoform allays the severest pains in a few minutes, and the relief endures for hours. Being non-poisonous, there is no danger in reapplying it as often as may be required after the first effect has ceased. Thus, in a case of ulcerated cancer of the face, where constant and excruciating pain rendered sleep impossible, orthoform to the amount altogether of fifty grammes was dusted over the sore for a whole week. Pain ceased, and no ill effects followed. The remedy is equally safe and effectual when administered internally as an anodyne in cancer of the stomach. Moreover, it is a powerful antiseptic, and consequently promotes healing. Orthoform has no effect on the unbroken skin, but, owing to its decided action upon mucous membranes, may prove valuable as a local anæsthetic previous to operations on that region—a question which is now being experimentally determined at Munich.

ABOVE THE CLOUDS, MOUNT TAMALPAIS, CAL.

CLOUD EFFECTS FROM MOUNT TAMALPAIS.

Hottest American Town.

The people who flee to the mountains and seashore in summer days, as if before a pestilence, when what they know as the heated term is on, can have no idea what hot weather really is until they have spent a few days in this old town on the Colorado River in Southwestern Arizona, says a correspondent of The Boston Transcript. The people who tell agonizing tales of their suffering in the periods of temperature among the nineties in the great cities ought to come out here in summer to know what Old Sol can do in the way of heat-making when he gets really down to business. What would you say to living in a spot where not a blade of grass may be seen, where there is nothing green but a few trees shimmering in the dusty sunshine, where the earth everywhere is so hot that one cannot stand upon it with bare feet, and where from June 1 to early in October the temperature is seldom below 90 degrees, and more generally about the 110th degree mark—once in a while running up to 123 and 125 degrees? What would you think of a temperature for a full month not less than 97 degrees, of two weeks at a time varying from 108 to 115 degrees, and even a week at a time over 112 degrees in the shade? That is what the residents of this quaint old town of Yuma have regularly each summer. Last summer the Yumas had two spells of weather when the mercury climbed up to 117 degrees in the shade every morning for a few successive days and descended to 96 and 100 degrees in the night. From June 10 to 14 the daily temperature ranged from 107 to 115 degrees. From June 18 to June 21 inclusive the temperature on each afternoon went as high as 117 degrees in the shade.

PROF. DOLBEAR says that what is called stupidity is simply the indication that a certain brain area is not properly nourished or is without communication with the nerve fiber.

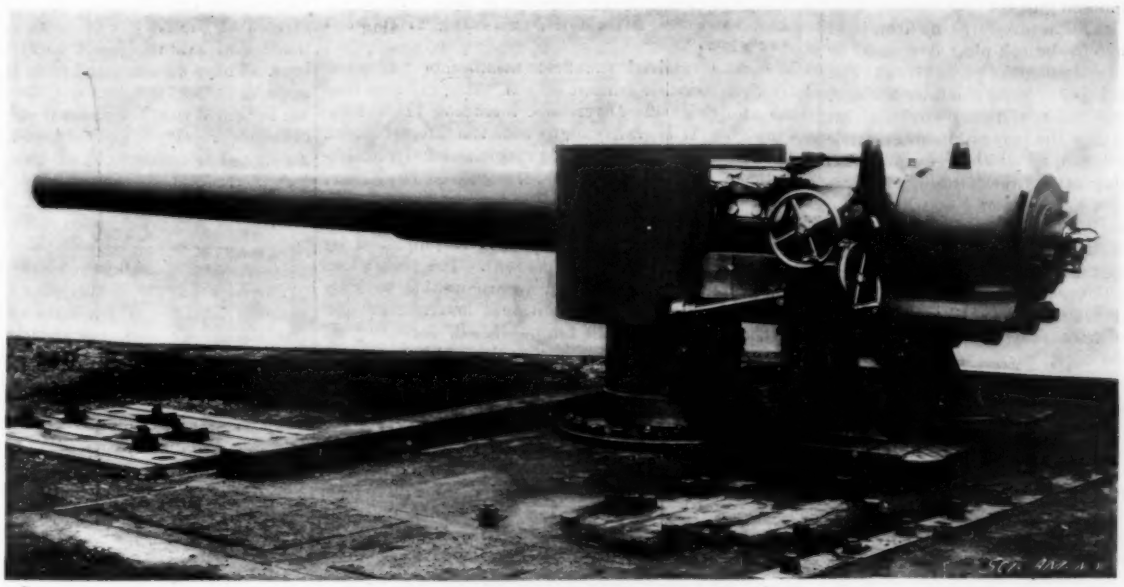
THE NEW HIGH POWERED GUNS OF THE VICKERS, SONS & MAXIM COMPANY.

Exceptional interest has been aroused in this country in the ordnance manufactured by the firm of Vickers, Sons & Maxim, on account of the purchase by our government for $200,000 of the right to use and manufacture the Vickers-Maxim breech mechanism, as applied to their rapid-fire guns. Further interest is due to the fact that the energy and rapidity of fire of these weapons places them well in the lead in the keen competition which exists between the leading manufacturers of ordnance.

If we were to mention in their order the most important desiderata in the modern rapid-fire gun, we would name first: The prevention of erosion (that is, the cutting away of the bore of the gun by the hot powder gases); second, rapidity of fire; third, high velocity. The introduction of smokeless powder is more than anything else the cause of the extreme velocity and striking energy developed in modern ordnance, and it has also contributed not a little to the great rapidity of fire. Unfortunately, however, smokeless powder brought with it a serious element of deterioration, which caused the artillerist considerable anxiety, and promised at one time to materially limit the useful life of the gun; for it was found that the white-hot high pressure gases resulting from combustion acted with a cutting or eroding effect upon the surface of the bore at the base of the shot. This erosion was ascertained to be chiefly due to the imperfect obturation of the copper rifling band which encircles the shell near its base. The object of the band is two-fold: It is intended to enter the grooves of the rifling and impart rotation to the shell, and it also serves as an obturator to seal up the space between the shell and the bore of the gun, and prevent the gases from passing by the shell. While the rifling band is thoroughly effective for the first purpose, it has proved to be a more or less imperfect gas-seal, a certain amount of the gases forcing its way past the shell as it travels up the bore. With the introduction of smokeless powder, the erosion became very marked, and was so serious, indeed, as to render some guns practically unserviceable after a certain number of rounds had been fired. The accompanying illustrations, Figs. 1 and 2, show a system of obturation which has been applied by the Vickers-Maxim firm to the base of the shell with very gratifying results.

Just back of the driving-ring may be observed what might be termed an obturating-ring, and just at the rear of this what might be considered a junk-ring. The obturating-ring is made of copper wire, asbestos yarn, plumbago, and a small percentage of paraffin wax. On firing the gun, the gases, by operating on nearly the whole surface of the junk-ring, force it forward and subject the obturating ring to a pressure about twenty per cent greater per square inch than the gas pressures in the gun. As the obturating-ring is of a semi-elastic nature, it yields under this enormous pressure, and makes a perfect gas-tight seal or joint between the projectile and the bore of the gun. It has been found in practice that this simple device practically prevents all erosion.

The device was designed by Hiram S. Maxim, assisted by Lieut. Dawson, the artillery expert of Messrs Vickers, Sons & Maxim. We are informed by Mr. Maxim that Lieut. Dawson has actually succeeded in applying this system to a gun in which the chamber had been so much worn as to greatly diminish the muzzle velocity of the projectile, with the result that the original velocity was restored.



VICKERS-MAXIM 6-INCH RAPID-FIRE GUN.

Length in calibers, 45; total length, 23·3 feet; powder pressure, 17 tons; charge, 25 pounds cordite; weight of projectile, 100 pounds; weight of gun, 7¼ tons; velocity, 2,775 feet per second; muzzle energy, 5,340 foot-tons; penetration of iron at muzzle, 21·1 inches; penetration of steel at muzzle, 16·4 inches; rapidity of fire, eight rounds per minute.

Rapidity of fire, which we have stated to be second only in importance to the prevention of erosion, has been greatly increased in the case of these guns by the new system of breech mechanism, the rights for which have just been purchased by the United States government. The most interesting feature is the breech-block, which was originally invented by a Swedish engineer, Mr. Alex Welin. The block is made in segmental portions in steps of varying radii, as shown in the accompanying illustrations. By this arrangement the block, if divided into eight segments, would have six segments, or three-quarters of its circumference, threaded for meeting the strains of the breech; whereas the ordinary cylindrical breech-block, with thread and plain surfaces alternating, would have only half its circumference threaded, the other half being useless for resisting the back pressure in firing. This enables the block to be shortened by one-third of its length, and of course its weight is proportionately lessened. As this shortening of the block, and therefore of the breech of the gun, takes place at the heaviest end of the gun, it can be seen that there is a very considerable saving of weight.

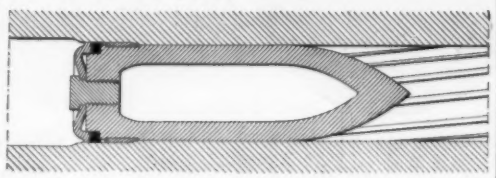


Fig. 1.—Obturating Ring Before Firing.

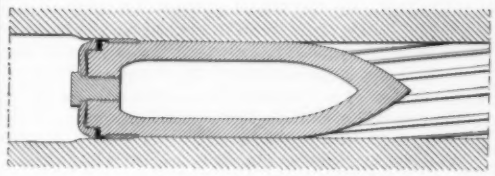


Fig. 2.—Obturating Ring After Firing.

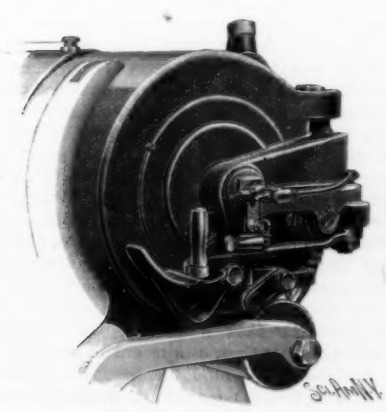
The shortening of the breech-block, moreover, renders it possible to employ the De Bange obturating pad at the end of the block, the block with obturator attached being still so short that it can be swung clear of the breech at once, on being unlocked, without being first drawn out of the breech-box on a line with the axis of the gun. The employment of the De Bange pad renders the cartridge case unnecessary, and thus the weight and cost of each charge are greatly reduced. The charge, being lighter, is more quickly handled, and a proportionate amount of time is saved. A further saving of cost and time is secured in not having to provide a cartridge-extractor or handle the empty case after the gun is fired.

The advantages of the new breech may be thus summarized:

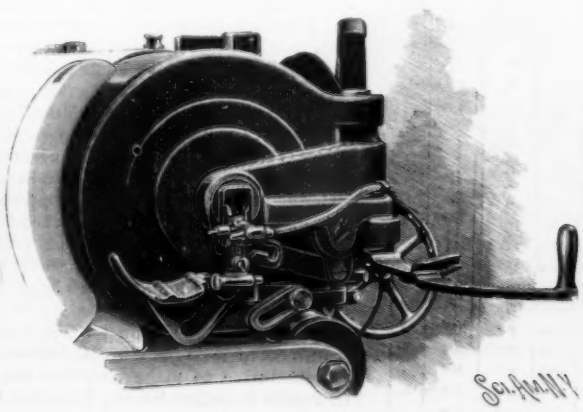
1. Saving of metal and weight in breech-block and breech of gun.
2. Small degree of rotation of breech-block in unlocking or locking.
3. The elimination of the motion of withdrawal of block in line with axis, rendering only two motions of the block and one swing of the lever necessary.
4. The abolition of the heavy cartridge case, with proportionate reduction in weight and cost of ammunition.
5. The abolition of the cartridge-case extractor, and the time saved in not having to handle the empty cases.

The efficiency of the new mechanism is shown by the fact that the firm has secured a rate of fire of 5 shots per minute from the 8-inch gun and 8 shots per minute from the 6-inch gun.

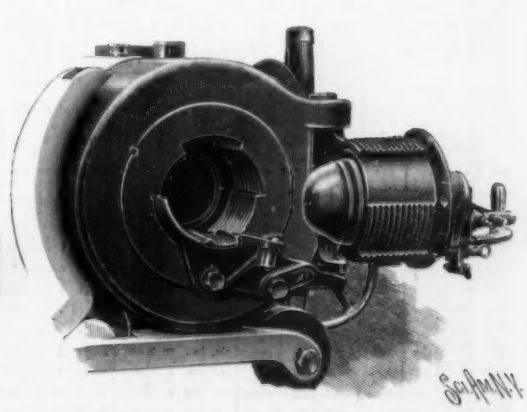
Next in importance to the prevention of erosion and the provision of rapidity of fire is the question of velocity. Upon the velocity, given a certain weight of shell, depend the energy, penetration, flatness of trajectory, and in a large degree the accuracy. The chief limitation to the use of high velocities has been the necessity of keeping down the powder pressures. High pressure has been attended by rapid erosion of the gun, as already explained. In the Vickers-Maxim gun, by the use of the obturating ring at the base of the shell the high pressure of 17 tons to the square inch is used without any serious wear of the gun, and a



Breech Closed, and Locked Hand-lever Across Breech.



Hand-lever Partly Swung Around, Unlocking Breech-block, and Disconnecting Firing Mechanism.



Hand-lever Swung Completely Around, Breech-block Withdrawn and Tray Thrown Up into Place.

standard velocity of about 2,750 feet per second is secured in the larger guns. With this high velocity it is possible to secure great energy and penetration with a gun that is relatively of small size and weight. Thus the 6-inch gun with a velocity of 2,750 feet per second has an energy of 5,340 foot-tons, as against 2,537 foot-tons for the old pattern English naval gun, which had a velocity of 1,913 feet per second. It will thus be seen that the energy of the new guns per ton-weight of the gun is vastly greater than that of the earlier patterns.

We have chosen the 6-inch gun for illustration. This weapon, like all those manufactured by this firm, is of the wire-wound type. The breech-plug is opened or closed by the horizontal movement of a hand-lever. The same action rotates, locks, or unlocks the breech-block, swings it in or out of the gun round the pivot on which it is mounted, and causes the percussion and electric striker to make or break contact at the required positions during the working of the mechanism. The arrangement consists of a link, one end of which is so pivoted on a pin projecting from the rear face of the breech-plug that the link works in a plane parallel to the breech face of the gun, while the other end is pivoted to a short crank mounted on the block carrier, and around the boss of this crank are formed "skew gear" teeth. The hand-lever for actuating the breech mechanism is pivoted on the block carrier, and moves in a plane at right angles to the breech face of the gun. Around the boss of the hand lever is fitted a skew gear wheel, which gears with the skew teeth formed on the boss of the crank. The whole is arranged and proportioned in such a manner that when the breech is closed, the hand lever lies close up to the breech face of the gun. This arrangement of centers and pivots, together with the relative lengths of the link and crank, provides great power when opening or closing the breech. On swinging the hand lever away from the gun, so as to open the breech, the crank moves the link past the locking center a short distance without causing any perceptible movement of the block. The further movement of the hand-lever causes the crank to turn, and by means of the link rotates the block, at first very slowly (thus obtaining great power) and then more rapidly, until it becomes unscrewed. The carrier then moves with the lever, swinging the block clear of the gun.

A loading-tray is provided, which is automatically moved across the breech face, and raised into the loading position when the breech is being opened, and lowered when it is closing. The firing gear is arranged for firing by electric or percussion tubes, and is operated by the movement of the hand-lever and link. It is so arranged that the first movement of the hand-lever, when unlocking the breech, acts on the firing gear and makes the gun absolutely safe before the breech-plug commences to unscrew. By the continuous movement of the link the empty tube or primer is automatically ejected.

The casemate mounting for these two quick-firing guns only differs in slight details. It consists of a steel top carriage, resting on balls, running on ball-bearings on a steel pivot. The cradle in which the gun slides is a cylinder; attached to the cradle are three cylinders, one to overcome the recoil, and the other two (one on each side of the recoil cylinder) contain the springs for running the gun up to the firing position after the recoil. The connection between these three cylinders and the gun is made by arms projecting from the breech-ring. The whole weight of the moving parts, gun, cradle, and carriage, is taken on the balls above referred to, so that the training is very easy. The elevating and training operations are performed by the rotation of two hand wheels, conveniently placed with regard to the shoulder-piece against which the gunner leans. These two hand wheels are worked on the left side of the mounting, which has also an auxiliary hand wheel on the right side, so that, if necessary, two men can conveniently train the gun. Subjoined we give a table of the weight, velocity, penetration, etc., of the various guns built by this firm.

VICKERS, SONS & MAXIM GUNS.

TYPE OF GUN.	Diameter of Bore.	Length of Bore.	Total Length of Gun.	Diameter of Chamber.	Length of Chamber.	Maximum Pressure in Chamber.	Weight of Charge.	Weight of Projectile.	Total Weight of Gun, including Breech Mechanism.	Muzzle Velocity per Second.	Muzzle Energy in Foot Tons.	Penetration of Wrought Iron Plate at Muzzle by Krupp's Formula.	Penetration of Steel Plate by Harvey Formula.	Rounds per Minute.
	in.	in.	in.			tons.	lb. oz. gr.	lb.	tons cwt. qrs. lb.			in.		
37 mm. 50 cal.	1.457	72.5	72.75	1.44	2.68	15	0 1 13 9	1.0	0 4 0 22	1800	72.5	1.9	1.5	300
37 mm. 47.5 cal.	1.457	69.0	94.0	1.6	3.78	16	0 3 0	1.25	0 5 1 26	2250	45	2.5	2.0	200
47 mm. 60 cal.	1.85	72.72	77.96	2.04	12.88	13	0 9 0	2.5	0 4 0 0	2125	103	4.5	3.5	30
47 mm. 47.2 cal.	1.85	87.36	91.5	2.04	12.88	13	0 11 0	2.5	0 4 2 6	2400	132	5.2	4.1	30
57 mm. 42.3 cal.	2.244	96.0	108.4	2.45	19.2	15	0 15 0	3.0	0 6 2 0	2300	220	6.2	4.8	24
57 mm. 60 cal. Naval	2.244	113.2	126.4	2.8	14.2	15	1 4 0	6.0	0 8 0 0	2300	360	7	5.4	25
76.2 mm. 45 cal. Naval	3.0	135.0	158.0	3.5	19.6	16	2 9 0	12.5	0 14 2 14	2600	528	9.2	7.1	20
76.2 mm. 50 cal. Field	3.0	150.0	173.0	3.5	19.6	16	2 9 0	12.5	0 15 3 0	2700	632	9.7	7.5	20
76.2 mm. 23.5 cal. Mountain	3.0	70.5	73.55	3.4	9.6	16	1 0 0	12.5	0 5 2 23	1700	250.4	...	...	20
75 mm. 10.7 cal.	2.953	31.6	35.85	3.0	4.333	9	0 0 11.5	12.5	0 2 0 13	913	72	...	...	14
101.6 mm. 45 cal.	4.0	180.0	198.1	5.0	21.2	17	0 0 0	25.0	1 13 0 0	2700	1,362	11.6	9.0	15
101.6 mm. 50 cal.	4.0	200.0	220.0	5.0	21.2	17	0 0 0	25.0	1 15 0 0	2800	1,550	12.3	9.5	15
12 cm. 40 cal.	4.724	189.96	193.38	5.1	23.5	16	0 0 0	40.0	2 10 0 0	2494	1,940	13.5	10.5	12
12 cm. 45 cal.	4.724	212.58	217.0	5.5	25.75	17	0 0 0	40.0	2 14 0 0	2600	2,169	14.1	10.9	12
15.24 cm. 40 cal.	6.0	240.0	249.2	6.8	32.5	16	0 0 0	100.0	6 15 0 0	2530	4,437	18.5	14.4	8
15.24 cm. 45 cal.	6.0	270.0	278.2	8.0	33.0	17	0 0 0	100.0	7 8 0 0	2775	5,860	21.1	16.4	8
20.3 cm. † 45 cal.	8.0	360.0	371.7	10.0	43.0	17	0 0 0	250.0	16 16 2 0	2700	11,012	28.0	20.2	5
23.36 cm. † 45 cal.	9.2	414.0	426.8	13.5	67.0	17	0 0 0	380.0	25 16 0 0	2750	19,227	34.3	25.6	...
25.4 cm. † 42 cal.	10.0	405.13	420.0	11.8	63.35	17	0 0 0	400.0	28 4 0 6	2600	20,811	32.5	25.0	...
31.40 cm. † 40 cal.	12.0	480.0	498.6	17.5	97.2	17	0 0 0	850.0	50 7 0 0	2700	44,873	40.0	35.5	...

† Now under construction.
All these guns use smokeless powder.

A Swedish Edition of "Magic: Stage Illusions and Scientific Diversions, Including Trick Photography."

We have received the first number of "Magiens Värld," a Swedish edition of our "Magic: Stage Illusions and Scientific Diversions, including Trick Photography." It is gratifying to note the interest which this volume has caused among magicians and publishers abroad, and we are not at all surprised that there should be a translation of this book. This work is published in Swedish by Messrs. Fahlcrantz & Company, of Stockholm, Sweden, and it is published by arrangement and with our consent. The translation is made by D. S. Hector, and we are unable to state whether there will be any additional material or not, but the entire book will be published, including all the illusions. We wish the Swedish publishers great success with their new undertaking.

A MEDAL AWARDED TO THE SCIENTIFIC AMERICAN.

A token of appreciation is always doubly welcome when no steps are taken to obtain it. We have been greatly gratified by the action of the jury on "Imprimerie et Industries de Livre" of the Brussels International Exposition in awarding the SCIENTIFIC AMERICAN a diploma of merit and a silver medal. We made no exhibit at the Exposition, and without our knowledge Col. George W. Roosevelt, United States consul at Brussels, kindly entered our paper for competition, and it was given the award named above. The medal is two and three-quarter inches in diameter. The

SILVER MEDAL AWARDED TO THE SCIENTIFIC AMERICAN AT BRUSSELS, 1897.

obverse is three figures modeled in high relief. The reverse has two lions rampant supporting a shield surmounted by a coronet, while underneath is the legend "L'Union fait la force" and the space for the name of the recipient. The sculptor was M. Jules Labue. The diploma has a female figure in the Barque of Progress whose attention is directed by another female figure to the Exposition building in the background.

American Commission Houses in Germany.

There is a movement on foot to incorporate a company under the laws of Germany, which will be prepared to erect suitable buildings for the display and sale of American products, provided manufacturers and dealers in America show a disposition to aid and encourage such an enterprise. This proposed company will construct buildings as desired by special interests, at an agreed rental, and will also be prepared to contract with the owners of merchandise to handle and sell their goods upon commission, and guarantee the payment of all bills of goods sold by them or their agents.

Germany appreciates our standing as a nation, and, I believe, would be willing to meet us half way in a fair exchange of commodities. Would it not be well for a number of our manufacturers to send over a representative to make a thorough investigation of the field, with a view to making arrangements with parties here for the housing and handling of their various products? The city of Cologne, from its favorable location, would make an excellent distributing point for all kinds of merchandise. It is a city of nearly 350,000 people, with railway and steamship facilities unexcelled in Europe. Docks and wharves of solid masonry extend for miles along the river banks. There are four railroad depots, the central station being one of the finest in the world, built and equipped at a cost of about $8,500,000. The chief custom house of the province is also located here. During the year 1897, there arrived at the harbor of Cologne 5,869 steamers, tow boats, and sailing vessels, carrying a total of 558,533 tons. There were shipped from this harbor during the same time 209,766 tons, in 4,765 vessels of all kinds. I am informed that the amount of goods and other merchandise received and shipped by railway in 1897 amounted to nearly 2,000,000 tons, and the value of the freight receipts aggregated $2,801,970.

JOHN A. BARNES, Consul.

Cologne, August 17, 1898.

Alpine Accidents.

The Alps have been this year the theater of the sensational fatalities which have become associated with the dangerous and fascinating pastime of Alpine climbing since the days of the beginning of this sport in the fifties. Within a few weeks five persons have lost their lives uselessly in this diversion. Dr. John Hopkinson, one of the most distinguished of England's men of science, with his son and two daughters, was killed while climbing the Petite Dent de Veisivi, a peak of 10,463 feet in one of the side valleys running up from the central valley of the Rhone. A few weeks later Prof. Masse, a well known surgeon of Berlin, met his death while climbing a peak of 12,000 feet—the Piz Palü.

The death of the Hopkinson family is particularly distressing. Dr. Hopkinson was an experienced Alpine climber, and the peak presented so few difficulties that he dispensed with the aid of a guide. Foolhardy mountain climbing is the cause of most of the serious accidents; and, while it is perfectly true that fatal accidents have happened where guides have been taken along, still there are many accidents which have happened to the unattended which might have been prevented had the services of a skilled guide been engaged. The Hopkinson family were all roped together, and a fatal slip of one of them set in motion the awful machinery for the catastrophe. A single misstep like that which occurred to Mr. Hadow in 1865, which caused the death of Lord Francis Douglas, Hudson himself, and the guide on the Matterhorn during the descent, after the top of the peak had been reached, may have been responsible for this last tragedy. It seems as though, even when the party are roped together with several guides, there is no guarantee of safety, and the ascent of even comparatively safe peaks without guides may be regarded as dangerous in the extreme.

The accident to Prof. Masse was of a different nature. In crossing a crevasse the ice bridge gave way, with the result that Prof. Masse fell down perpendicularly, dragging the guide after him, while his friend Dr. Borchard and the Tyrolean guide had to support the weight of the entire party. Eventually, the guide who was at the end of the rope, having discovered that the bottom of the crevasse was not far off, cut himself loose and scrambled out with the help of his ice ax; but when he came to the rescue of Prof. Masse, he found that the latter's death had been caused by the rope which he himself had insisted upon being tied under his shoulders. The consequence was that the rope was pulled taut and the professor's circulation was suspended.

An Exhibition of Snakes.

A curious exhibition will begin in New York on November 12. It is termed the International Snake Exhibition and will open in Grosvenor Hall, East Fifty-second Street, New York. Scientists who are interested in snakes will undoubtedly bring specimens. Mr. R. L. Ditmars, former Assistant Curator of the American Museum of Natural History, who has studied the habits of snakes for many years, is attending to the arrangements for the show. The exhibition will be unique as to size. There have been small displays of snakes in museums and at the World's Fair, but never a comprehensive exhibition. Certificates of merit will be issued for meritorious exhibits. Stuffed snakes and snakes preserved in alcohol will also be shown. It is expected that there will be one hundred and fifty to two hundred varieties of reptiles on exhibition.

WE learn from The Fort Wayne Medical Journal Magazine for September that, at a recent examination before the medical board of Louisiana, Dr. Emma Wakefield, a young negress, passed a successful examination. She is the first woman in the State of Louisiana to study medicine, and the first negress in America to receive a medical diploma.

The World's Production of Wine.

According to the Moniteur Vinicole, the world's wine production for 1896 and 1897, by countries, was as follows:

Countries.	1897. Gallons.	1896. Gallons.
France	854,713,420	1,179,811,720
Algiers	115,402,560	107,001,000
Tunis	2,377,800	2,509,200
Italy	685,836,760	569,958,660
Spain	510,338,000	471,068,600
Portugal	66,050,000	86,657,000
Azores, Canary and Madeira Islands	6,605,000	8,454,400
Austria	49,556,000	66,050,000
Hungary	31,704,000	43,593,000
Germany	55,482,000	82,166,300
Russia	66,050,000	76,618,000
Switzerland	33,025,000	39,630,000
Turkey and Cyprus	49,556,000	80,581,000
Greece	31,704,000	56,803,000
Bulgaria	28,797,800	35,931,200
Servia	24,306,400	29,062,000
Roumania	85,544,000	198,150,000
United States	30,303,740	17,965,600
Mexico	1,585,200	1,849,400
Argentine Republic	38,044,800	42,007,800
Chile	73,976,000	45,706,600
Brazil	10,303,800	12,549,500
Cape Colony	5,151,900	2,377,800
Persia	660,500	845,440
Australia	2,404,220	4,955,500
Total production	2,843,478,920	3,262,103,820

If these statistics are authentic, the wine production of the world decreased immensely during 1897, which hardly seems true. France, Hungary, Russia, Roumania, and Australia all contributed to the decrease, while the output in the United States greatly exceeded that of the previous year.

English Trolley Lines.

Within the next few months there will be several new electric trolley tramways opened for traffic in England. So far as length, etc., are concerned, the lines are of no particular importance, but from other points of view they are important, for upon their success or failure may depend the equipment of many miles of way. The lines to which we refer are mainly short experimental sections, two or three miles long, which are being equipped on the overhead trolley system by municipal authorities, who are desirous of changing the complete town tramways over to mechanical power, but are not altogether convinced as to the best form of traction to adopt. The corporations of Liverpool, Glasgow, Sheffield, Bradford, Hull, are all equipping short lines with the trolley. At Liverpool cars from America and Germany will be put in operation, and in addition to these a special design of car is to be made in the neighborhood of Liverpool, so that nothing may be left undone to have everything right in this respect. In each of the other towns mentioned the preparation of track, erection and equipment of power house, and so forth is being pushed forward energetically. At Plymouth also the municipality is at work in the same direction, while at Halifax and Middlesbrough lines are in so forward a state that any week may now see their completion.

Most of these towns have in a greater or lesser degree had recourse to American plant, either for inside or outside work, much to the disappointment of the English contractor. But it seems that more than usual importance attaches to a line which has just been completed between the towns of Kidderminster and Stourport, on account of the fact that the plant and machinery are all of English make and the undertaking has been from first to last carried out by an English firm, i. e., the Brush Electrical Engineering Company, of London. The power plant comprises Babcock & Wilcox boilers, "Universal" type, single crank compound type steam engines, direct-coupled six-pole generators with Mordey's new chord winding and notched armature. The switchboard is split up into the usual panels, main station, generator, feeder, and Board of Trade. The track is single throughout, of 3 feet 6 inches gage. The power station is a mile from Kidderminster and three and a half miles from Stourport, making the line four and a half miles long. Owing to certain difficulties on the route, the Dickinson side trolley is employed. A main feeder cable goes to Kidderminster, and also one to Stourport. The cars, which have Brill cantilever type trucks, are fitted with two 15 B. H. P. four-pole motors of the ironclad type. The line is the first of many similar tramways to be equipped by the British Electric Traction Company, which is stated to have over $15,000,000 of such undertakings in progress—either negotiating or constructing.

Owing to the numerous delays which arise in complying with the various legislative requirements when applying for tramway powers, many schemes are being promoted as light electric railways, and in this way the powers are secured much more promptly. Opposition to the overhead wire is not dead yet, for quite recently one or two good schemes have been abandoned purely on account of the opposition raised on this score. The London County Council has long pledged itself to resist the overhead wire, and this has led to several schemes, which are now under consideration, for districts which are just outside the London County Councils jurisdiction area.

SPIRIT SLATE WRITING AND KINDRED PHENOMENA.—V.

BY W. E. ROBINSON.

There is still another style of slate writing which is used to good advantage by some mediums. It consists of two slates hinged together, making a double slate. It has two holes in the frame opposite to the hinges, through which a tape or cord can be run and tied and sealed to the slates. (Fig. 11.) The writing is

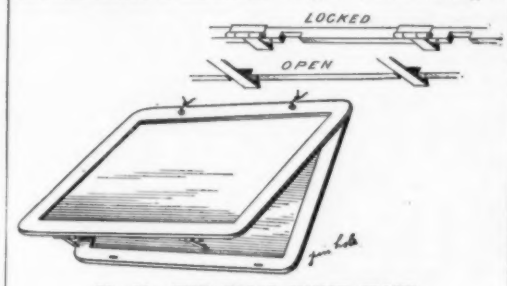


Fig. 11.—THE FALSE HINGE SLATE.

placed upon the inside, owing to the fact that a half of each hinge is screwed to one slate; the other half is made fast to a little projecting piece in which there is a slight notch. These projecting pieces enter corresponding holes in the other slate, in which there is concealed a spring bolt, which engages these catches of the hinge. When it is desired to open the slate for the purpose of writing upon it, the bolt is lifted back by means of a pin pushed through a hole in the end of the frame, as indicated in the engraving.

The following is a method by which writing can be made to appear on a slate on which a person has

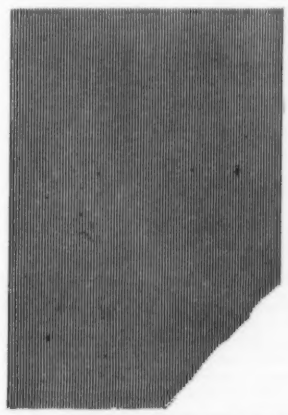


Fig. 12.—THE INTERRUPTED FLAP.

placed his initials in one corner. The slate is then placed with that side downward on the table, and shortly afterward, on turning it over, it is found completely covered with writing, and the signature of the visitor proves there has been no exchange of the slate. The method of obtaining this effect is unique. The writing is already on the slate, but hidden from view by the false flap, but with the corner missing from it. (Fig. 12.) The cleverness of the trick is in this corner. After the medium closes both slates, he says he will just draw a chalk mark down in the corner of the slate, wherein the gentleman is to place his signature. He

Fig. 13.—READING QUESTIONS BY MEANS OF MIRRORS.

really draws the chalk mark on the slate proper, but close to the edge of the missing corner of the flap, thus disguising the line of demarkation between the slate and the flap, and after the flap is dropped into the slate, of course, this mark of the signature still remains.

Another interesting test is as follows: A person writes a question on the slate, and places it face down on the table when the medium is not looking. The latter now takes his seat at the table, places one hand on the slate, as also does the skeptic; the other hand is placed on the medium's forehead. With the disengaged hand the medium now proceeds to write on the upper surface of the slate. When he has finished, the communication is read, and it is found to be a correct answer to the question on the opposite side of the slate. To perform this seeming impossibility, the medium has to employ a table containing a trap smaller than the frame of the slate. When the slate is placed on the table, the medium shifts it over this trap and the trap is then open, and by means of mirrors in the body of the table the writing is reflected to the very place where the medium is sitting, and it is easy to then give an answer to the question. Fig. 13 shows the nature of the device. Double mirrors are used, in order to cause the reverse writing on the mirror to be again reversed.

With this trick the present series of articles comes to a close. There has been so much interest exhibited by our readers in these exposés of slate writing that the publishers of the SCIENTIFIC AMERICAN have decided to publish the entire manuscript in book form. Only a portion of it has been published in the five articles which have been devoted to it. The work will be published within a month, and it will contain a large number of other tricks used by mediums to deceive their audiences. It will include, in addition to all of the slate writing devices which have been illustrated, many which we have not shown. There will also be chapters on mind reading of all kinds and kindred phenomena, mental magic, table lifting and spirit rapping, spiritualistic ties, post tests, handcuffs, spirit collars, seances, etc. A number of new stage illusions will also be given.

Our New Cruiser "Albany."

The Navy Department is anxious to get the protected cruiser "Albany" in American waters, and an examination is being made to ascertain whether there would be any impropriety in asking the British government to release the vessel before the war is officially ended. Spain may possibly object to favorable action on the request by Great Britain, taking the ground that while hostilities have ceased by agreement, the war is still technically in progress. The "Albany" is not entirely completed, but she is in a condition to make the voyage across the Atlantic. The "Albany" was built by the Armstrong Company at their shipyard on the Tyne for the Brazilian navy, and she was christened "Almirante Abreuil." The United States government purchased her from Brazil before the war with Spain, and she was renamed the "Albany." Her sister ship is the "Amazonas," which did such satisfactory work at Santiago and elsewhere under her new name "New Orleans." Our government did not wish to purchase the "Albany," because she was not nearly finished, but Brazil would not sell the "Amazonas" unless the other vessel was also taken. The "Albany" will make a welcome addition to our navy.

The Current Supplement.

The current SUPPLEMENT, No. 1192, contains a large number of interesting papers. The front page shows a spirited portrait of Emperor William in the uniform designed by himself for his journey to Palestine. "The Uniform of the French Army" describes the latest accouterments of the soldier, which are regarded by military authorities as being eminently satisfactory. "The Graphophone at Omdurman" illustrates the use of this instrument in the heart of Africa. "Lightning on a Kite Wire" describes some interesting experiments which have been carried out by the officers of the Weather Bureau. "Portland Cement Industry of the World" is an important paper by Bernard L. Green. "German Blacksmith's Art" describes the manufacture of wrought iron gates, lamps, etc. That the Germans excel in blacksmith work has been abundantly shown by the magnificent gates which gave access to the German section in the Liberal Arts building in Chicago, at the Fair in 1893. "Inebriety and its Cure Among the Ancients" is a curious article by William L. Brown. Prof. Weldon's paper, read before the British Association, is concluded in this number, and the "Advance of Psychology," by Prof. J. McKeen Cattell, is also given in this issue.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

PLANT-SETTER.—JOSEPH C. MORRIS, Tampa, Fla. By means of this instrument openings for plants can be made in the ground and plants growing in sandy soil can be watered without causing the operator to assume a fatiguing, stooping posture. The plant-setter is provided with a vessel in which water is stored. A tubular shaft is attached to the vessel and has an opening within the vessel. A drill is attached to the shaft and has an opening therein communicating with the opening in the shaft. A valve normally closes the opening in the drill and is connected with a lever. By operating the lever, the water may be allowed to flow through the drill into the ground, thus providing sufficient moisture to nourish the roots of the plants to be placed in the hole.

BRUSH-CUTTING MACHINE.—ALFRED L. HASTINGS and LUCIUS M. SCOTT, San José, Cal. This machine is provided with curved rake-teeth, the upper ends of which are hung loosely on a shaft supported in the frame of the machine. The points of the teeth extend in a forward direction close to the ground. Knife-guards supported on a transverse rod, extend between the rake-teeth at the rear and above the points thereof, the lower edges of the guards being curved upwardly and forwardly from the rake-teeth, and the lower ends of the guard-points extending below the top surface of the rake-teeth, when the latter are in operative position. Revoluble S-shaped cutters are secured on a transverse shaft journaled in the frame forward of the rod carrying the guards, and operate in conjunction with the guards to cut the brush passing up the teeth and onto the curved edges. The cutters are rotated by moving the machine over the ground.

STUMP-BURNER AND INSECT-EXTERMINATOR.—VICTOR RIEKE, Franklin, Minn. This apparatus comprises a wheeled vehicle, a rotary table on the vehicle, one or more concentrating lenses adjustably mounted on the table, and a heat-plate carried by the vehicle and receiving the rays of the sun after these rays have been brought to a focus by the lenses. In burning stumps or cracking stones, the vehicle is brought close to the stump or stone, and the table adjusted so as to cause the lenses to concentrate the sun's rays upon the object. In destroying insects, the rays are concentrated upon the heat-plate, the vehicle with its heated plate being then passed over the grass to destroy the insects by the radiation of the heat.

Mechanical Devices.

ORE-CONCENTRATOR.—DAVID D. LORD, Colorado Springs, Col. This ore-concentrator comprises a series of inclined plates, a drum having pockets to receive material from the plates, a receiver forward of the upper end plates and a vertically-movable gate between the receiver and the plates. A cylinder is mounted to rotate in the lower portion of the receiver and has a series of chambers extended through it, these chambers having outward openings into the receiver, independent pipe connections with the chambers and valve-controlled outlets leading into boxings at the lower portion of the receiver. The receiver is half-filled with water and the crushed ore placed therein. Water is injected into the chambers of the cylinder and forced out through slots. By adjusting the valves, the amount and force of the water used in separating the ore may be regulated.

SEED-CLEANER.—WILLIAM A. RICE, Jerseyville, Ill. By means of this invention most forms of grain can be quickly and conveniently cleaned. The device consists essentially of an endless belt passing about rollers up an incline, located at one or more points on its course. The seed is delivered upon the belt at the bottom of the incline, and is prevented by gravity from passing up the incline. The foreign matter is, however, caught by the belt and carried over a roller.

COIN-FREED MACHINE.—MARTIN HOMMEL, Geislingen, Germany. The purpose of the present invention is to provide cloak-rooms and similar places with devices by means of which the services of a special attendant are rendered unnecessary, the articles deposited being safeguarded against theft. The device in question consists of a holder so arranged that hats, cloaks, sticks, or the like, after the insertion of a coin, can be securely fastened by means of a key. This key is at the same time automatically delivered to the user. When used again to unlock the holder, the key is held automatically in position, so that it cannot be taken away while the holder is released.

WIND-WHEEL APPARATUS.—CASSIUS S. GRAVES, Bad Axe, Mich. With an upright support and a hollow driven shaft hung from the support and rotatable thereon, is connected a crown-wheel secured on the upper end of the driven shaft and rotatable on the support. A hollow cross-head revoluble on the upper part of the driven shaft is provided with a lateral arm having a loose bearing on the upper side of the crown-wheel. A wind-wheel having a pinion meshed with the crown-wheel rotates on a shaft projecting from the cross-head. A vane is hinged to swing laterally on a shaft projecting from the cross-head. By means of a flexible connection extending from the vane through the cross-head and hollow driven shaft, the vane is controlled and enabled to cause the wind-wheels constantly to face a wind-current. The advantages claimed for this invention are its simplicity and cheapness.

MECHANISM FOR CONVERTING MOTION.—FRED C. THOMPSON, Burton, Wash. This mechanism is provided with a shaft to which a wheel is fixed. Two disks loosely mounted on a shaft are arranged one on each side of the wheel. Each disk carries a clutch which engages the wheel and imparts movement thereto when the disks move each in a certain direction. A gear-wheel is employed in connection with each disk. Two sectors swinging independently on a common axis respectively engage the gear-wheels and are capable of oscillating in a plane transversely to the shaft, whereby the shaft is continuously driven. Independently reciprocal rods are connected with and swing the sectors. The mechanism is particularly applicable to windmills.

Railway Appliances.

RAILROAD-TIE PLATE.—SIMON D. S. NARBER, Le Grand, Ia. The plate for railroad-ties provided by this invention is an improvement upon a similar contrivance patented by the same inventor. The present device has a base-plate lying flat and solidly on top of the tie and adapted to fit underneath the rail. The base-plate has a groove or recess on its underside transversely to the rail and opening at its edges. Forked clamp-bolts are also provided, one prong of which is adapted to lie above the tie but to lock under the base plate in the groove or recess, and the other on top of the base-flange of the rail. A fastening device at the outer end of the clamp-bolts secures the latter to the tie.

Miscellaneous Inventions.

ARTIFICIAL LIMB.—REDMON F. SMITH, Gallatin, Mo. It is the purpose of this invention to provide an artificial limb for legs amputated either above or below the knee. With the lower member a foot is connected. A sleeve forms the lower part of this member and has on opposite sides vertical slots provided with upwardly-inclined notches. A foot shank-piece is adapted to fit in the sleeve and has lateral, headed pins adapted to slide in the slots and engage the notches. The leg-members are pivoted together. To the lower portion of the upper member a spring is permanently attached at the rear side. With transversely fixed cross-bars the lower portion of the spring has free sliding contact, the spring working on the upper bar as a point of leverage.

DISPLAY-CASE.—WILLIAM H. GASSAWAY, Victor, Col. The display-case of this inventor belongs to that class of display-stands provided with a central post having trays or shelves. The case revolves about a vertical axis. The corner posts are connected at the top by two curved arches. Shelves, in two sizes, are placed alternately on the center-post and are securely held in position by spring-brackets. The construction is such as to permit the stand to revolve and display the articles placed on the shelves.

UMBRELLA.—THOMAS A. WILKINSON and ANNA C. WILKINSON, Cincinnati, O. In this folding umbrella, various improvements are embodied by means of which the umbrella may be folded into a small space. The ribs of the umbrella are composed of members sliding one upon the other at their meeting ends, and provided with devices that connect the members and lock the outer one when extended. One of these members has a curved portion at its locking end, which portion may be straightened to unlock the members and permit the umbrella to collapse. The umbrella-stick is jointed so that it can be readily folded.

FOLDING-UMBRELLA.—THOMAS A. WILKINSON and FREDERICK A. WILKINSON, Cincinnati, O. In order that the umbrella provided by this invention may be readily folded, the ribs are made in inner and outer sections slidably connected by loops spaced apart. The portions between the loops form a spring, which is shortened by extending the rib to position for use. A stretcher is pivoted to one of the sections and has a cam by which the sections are clamped together when the umbrella is opened for use. The umbrella-stick is jointed to permit it to be readily folded.

TROLLEY-POLE.—VIRGIL A. MASON, Austin, Tex. The improvements embodied in this invention seek to provide a simple construction whereby a trolley-pole may yield laterally to conform with curves and may yield vertically at its upper end to pass hangers and other obstructions on the wire. To permit the lateral play of the trolley-wheel, the inventor provides the pole with a flattened portion setting vertically edgewise, thus giving sufficient strength vertically and permitting the lateral bending of the pole to enable the wheel to adjust itself to the wire when passing curves. To permit the pole to adjust itself vertically, the inventor makes his pole in a butt-section and a wheel-section, the former being pivotally connected with the car and the latter jointed to the butt-section. By means of a spring, the wheel is pressed firmly against the wire, the construction, however, enabling the pole to yield downwardly in order to pass obstructions on the wire.

GATE.—BENJAMIN H. HESTER, McAlester, Indian Ter. The purpose of this invention is to provide a gate which may be automatically operated by the person riding or driving toward and from the gate. When a vehicle approaches the gate, its front wheel will operate a lever to release a detent momentarily, causing the gate to swing one step and bringing one of four stop projections on the gate into contact with the detent. The detent will then be released by the hind wheel of the vehicle and the gate will be opened. These operations of the tripping lever and the resulting opening of the gate will lower a weight, which will be rewound by the pressure of the vehicle on the lever. As the vehicle moves through and from the gate, its wheels will actuate another tripping-lever, to operate the detent-bolt twice, causing the weight to readjust the gate to its closed position.

INCUBATOR.—EDGAR B. FISHER, United, Pa. This incubator comprises a casing, a hot-air-tank in the upper portion, and partitions extending from the hot-air-inlet end of the tank nearly to the opposite end, thus providing three communicating chambers. The center chamber is shallower at the hot-air inlet end than at the other end. A hot-air flue communicates with the center chamber at its shallow end. A jacket surrounds the flue and a conduit leads from the jacket to the interior of the casing below the hot-air-tank. A water-vessel is provided to supply, by means of the conduit, the moisture necessary to the hatching of the eggs.

EXPANSION-BOLT.—JAMES F. DOWNES, New York city. This expansion-bolt comprises a sleeve formed as a short tube-section, having longitudinal slots therein extending inwardly from one end and an exterior peripheral head or flange at the split end. A cone is adapted to enter the split end of the sleeve and has a cylindrical section at its small end whereby the sleeve is enabled to hold the cone without being itself expanded. A threaded bolt draws the cone into the sleeve.

GUN-SUPPORT.—AUGUST W. ZUBERBIER, Logan, Minn. In order to enable a gun to be balanced or supported when being carried to relieve the gunner from fatigue, this inventor has devised a support consisting of an adjustable strap passing around the shoulders, the members of which converge and meet at their lower ends, being continued for a short distance after meeting. A hook, shaped to receive the gun, is held between the meeting ends of the strap and inclosed thereby, whereby a covering is formed for the hook.

TRUNK-FASTENING.—GEORGE A. TUCKFIELD, Salt Lake City, Utah. The trunk-fastening provided by this inventor belongs to that class in which chains or ropes are made to encircle the trunk so that by means of a tension device the chain or rope may be properly strained. The present fastening consists of a main chain having connection with a turnbuckle. A branch chain is attached to the main chain, and is capable of connection with the turnbuckle. A lock holds the branch chain in the connection.

AUTOMATIC CUT-OFF FOR WATER-SPOUTS.—WILLIAM A. MADDIN, Muscogee, Indian Ter. In its natural position this cut-off is designed to conduct the water that first falls on the roof to the waste pipe; but after a short period, when the roof has been washed by the first flow of water, the cut-off will automatically so change its position as to direct the flow of water from the roof to the cistern-pipe until the rain ceases, whereupon the cut-off will again return to its normal or natural position. The cut-off may be held stationary whenever so desired, and the water may be made to flow continuously to the waste pipe.

MUSIC-SHEET AND TURNING DEVICE THEREFOR.—ALMON J. PIERCE, New York city. With rollers and a motor for rotating the rollers at a uniform speed, are connected music-sheets having the time of the music printed thereon and the staves differently spaced so as to accommodate the time of the music to the speed of the motor. As the forward movement of the motor is uniform in velocity, it is necessary so to print the staves of the music-sheet as to compensate for the relation between the speed of the motor and time of the music.

PROCESS OF PRODUCING CARBIDS AND METALS OR ALLOYS SIMULTANEOUSLY.—HEINRICH ASCHERMANN, Cassel, Germany. The inventor of the present process claims that he has secured a greater saving of energy in electric furnaces than can be obtained by the use of metal sulfids. He has at the same time secured the production of carbids, by adding a sufficient quantity of carbon to a mixture of an oxid of one metal and a sulfid of a different metal. Under the action of the electrical current, the inventor states that the carbon will combine with the metal having the greater affinity therefor, while the other compound will be reduced to the metallic state. The carbid, it is claimed, is as pure as that produced in the ordinary way, while the consumption of current is, according to the inventor, at least forty per cent less.

FIRE-ESCAPE.—JAMES REIDY and JAMES NAUGHTON, Pontoosuc, Mass. This invention provides an improvement in fire-escapes of that class in which a spool carrying a cable is used, means being provided by which the spool's turning may be controlled. The fire-escape comprises a frame formed in two parts, hinged together and provided with shaft bearings in the hinged joint, means being provided by which the two parts may be rotated together. A shaft is mounted in the bearings in the frame and has a thrust-bearing at one end. The spool is journaled on the shaft and is engaged by friction-disks held against rotation. The upper section of the frame is provided with a cable-guide. A belt, by means of which a person may be lowered, is suspended from the lower section of the frame.

ROTARY RACK.—JOHN F. FINAN, Lonaconing, Md. By this device the inventor seeks to provide a simple construction of rack in which the arms supporting the garments are carried by slides operating in an upright post of special construction, the slides being so arranged and engaged that one, two, or all may be raised at one operation. The arms are so arranged relatively to the slides and coacting parts that the slides may be set to hold the arms at half-mast. The slides may be divided transversely into sections, so that one or more arms may be adjusted for use independently of the others.

Designs.

GAME-BOARD.—JAMES P. NOLAN, Westfield, Conn. The leading feature of the design consists of a star-shaped figure arranged within a rectangular base, the edges of which base are raised. Following the outline of the star is a five-sided figure.

PUZZLE-CASE.—JAMES H. MCNEILL, Mineral City, Va. This design provides a puzzle-case having a conical bottom provided at the apex with a cavity. A vertical inclosing wall surrounds the bottom. The puzzle consists in attempting to roll a ball up the conical bottom so as to cause the ball to fall through the cavity.

EGG-CARTON FILLER.—ROBERT J. BARKLEY, Chanute, Kan. The leading feature of this design consists in an oblong filler presenting three longitudinal strips, crossed by other strips, with the outer two strips of the first-named three at the end portions of the second-named transverse strips. These transverse strips extend beyond the longitudinal strips, the projecting ends being parallel with adjacent vertical slits appearing in the outer longitudinal strips.

CLIPPING-HOLDER.—CHARLES E. SCHWARTZ, Stanford University, Cal. This design has as its leading feature connected covers and a flap extending from one end of one of the covers. The clipping is attached to the flap and folded in any convenient manner. Over the folded clipping the cover is bent. Upon the outside of the cover are written or printed the subject and source of the inclosed clipping. The device is an improvement over the old form of preserving clippings, its simplicity and cheapness being noteworthy.

BICYCLE HANDLE-BAR.—ROGER B. EAMES, South Framingham, Mass. The leading feature of this design consists of an L-shaped member and an arm extending rearwardly and laterally at an angle to the stem of the L-shaped member. The reversible position of the handles deserves attention. While the handle-bar can be used with both hands, the inventor states that it can also be operated with one hand, and that when so used increased control is obtained. Equipped with this handle a bicycle can be made to stand against a wall without danger of having the front wheel run back and upsetting the bicycle.

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(7514) F. J. T. asks: What would be the horse power of the smallest dynamo which would furnish current sufficient for the amateur furnace described in SUPPLEMENT, No. 1182? A. The electrical furnace is rated to use about 10 amperes at 110 volts. A dynamo capable of giving this current should have about 2 horse power in the engine which runs it. This furnace is but a little one.

(7515) R. B. C. asks for a formula for a good cheap liquid laundry bluing. I wish to manufacture it on a small scale. A. Water, 15 parts; dissolve in this 1½ parts indigo carmine. Add ¾ part gum arabic.

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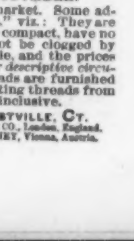

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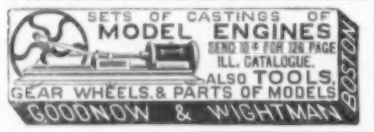
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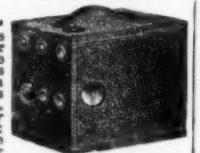

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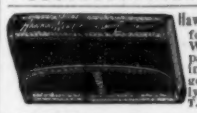

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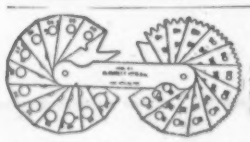

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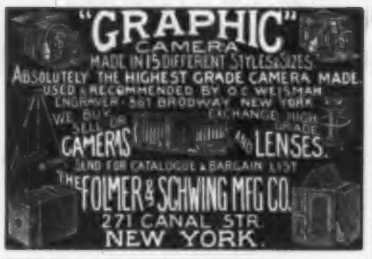
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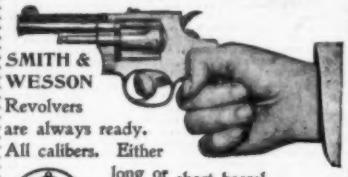

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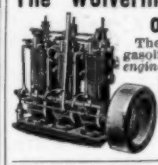

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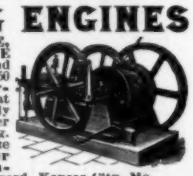

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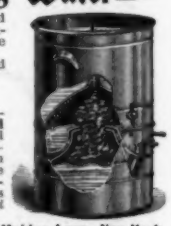

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